

Australasian Plant Conservation

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Celebrating the 30th
anniversary of APC [Part 1]

ANPC INC. MISSION STATEMENT: To promote and improve plant conservation

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Front cover: Assessing the impacts of
shrub removal on erosion at 'Bloodwood'
north-west of Bourke early 1992.
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Australasian Plant Conservation

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Australasian Plant Conservation

Australasian Plant Conservation is a forum for
information exchange for all those involved in
plant conservation: please use it to share your
work with others. Articles, information snippets,
details of new publications or research and
diary dates are welcome. General articles on
any plant conservation issue are most welcome.

The deadline for the autumn issue is
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an article or wish to discuss possibilities,
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This issue

From the editor <i>by Heidi Zimmer</i>	2
The first twelve years – an outline history of ANPC, 1991–2003 <i>by Bob Makinson and Mark Richardson</i>	3
Retrospectives and perspectives on plant conservation in Australasia	7

Regular features

News from the Australian Seed Bank Partnership Australasian Seed Science Conference 2021: Linking seeds with needs; <i>securing our future in a changing world</i> <i>by Cathy Offord, Sal Norton, Lydia Guja and Damian Wrigley</i>	21
Forward together: ANPC-led Guidelines informing conservation, restoration and translocation practice <i>by Amelia Martyn Yenson, Lucy Commander, Cathy Offord and Tony Auld</i>	26
Member profile	30
Book review	31
News and conferences	32
Research round up.....	42
ANPC Corporate Members	45

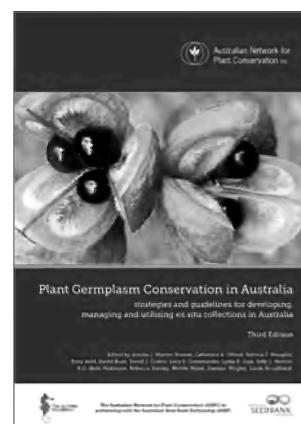
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From the editor

HEIDI ZIMMER

2021 marked the 30th anniversary of the establishment of the Australian Network for Plant Conservation. To honor this auspicious occasion, we present you with the first of two special anniversary issues of Australasian Plant Conservation (the second to be published in autumn 2022). We begin this issue with a walk down memory lane, where Bob Makinson and Mark Richardson tell the story of the early years of ANPC. This is followed by a collection of contributions entitled "Retrospectives and perspectives on plant conservation in Australasia".

For this article, 22 people from across the Australasian plant conservation community shared their responses to the questions: "What were you doing in 1991 and what are you doing now? How things have changed in the past 30 years." and/or "What are the past, current and emerging issues for plant (or biodiversity) conservation in Australia (or Australasia)?" The range of responses is almost as diverse as our Australasian flora. Sit back, grab a cuppa and enjoy. Happy anniversary ANPC.



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The first twelve years – an outline history of ANPC, 1991–2003

BOB MAKINSON AND MARK RICHARDSON

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The establishment of the Australian Network for Plant Conservation was strongly driven by the IUCN World Conservation Strategy (1980), as well as the Botanic Garden Conservation Strategy (1989) which had led the Australian National Botanic Gardens (ANBG) located in Canberra to adopt plant conservation as a major goal. In 1986, the ANBG established an endangered species collection, and in 1989 it issued a report on rare and threatened plant species in cultivation in Australia (Meredith and Richardson, 1989).

To further develop the *ex situ* conservation of plants in the Australian botanic gardens community, a national conference was convened by the ANBG in 1991 on the theme of “Protective Custody? *Ex situ* Plant Conservation in Australasia”. Given the expertise and botanical resources of the ANBG and other interested botanic gardens, a natural aim was to maximise their effectiveness in conservation by *ex situ* means (the maintenance of living plant material away from the wild). That goal sat alongside a realisation that there was a much wider need for a national voice specifically for plant conservation. So, although the conference title focussed on *ex situ* conservation, all organisations and individuals involved in plant conservation in Australia were invited, as well as representatives of Botanic Gardens Conservation International based in the UK, and the Center for Plant Conservation in the US.

Following the 1991 conference, a broader call was circulated nationally, a “Proposal for an Australian Network for Plant Conservation” (Richardson, Falk, Wyse Jackson, Butler and Meredith, 1991). An important aspect of the proposal was that the ANPC would involve integrated plant conservation in the sense of Falk (1987), *i.e.* a focus on both *in situ* and *ex situ* conservation. The vision was ambitious, and was planned in considerable detail; a summary of the 1991 conference outcomes, and progress up to June 1992 (<https://www.anpc.asn.au/history-of-the-anpc>), outlines structures and activities that for the most part would remain relevant over the following decade, and some up to today.

The concept, including that of a base in botanic gardens as relatively durable and independent institutions, was inspired in part by the successful model of the gardens-based US Center for Plant Conservation.

However, the practicalities were all shaped by Australian realities. An at least equal level of inspiration came from the Australian Landcare movement, just then taking shape and already demonstrating that a bridge between the environmental and farming sectors was possible and could attract government support and policy change.

The ANPC was established in early 1991. A national *ANPC Newsletter* was published from late 1991 (to be renamed as *Danthonia* in 1993, and then as *Australasian Plant Conservation* in 2003). A national office was established at the ANBG and Mark Richardson was the founding co-ordinator (until 1995).

Finding a niche: 1991–1996

The potential benefits of a new conservation body seemed clear just in terms of better national and international exchange of expertise, but there were also deeper considerations:

- The Australian plant conservation scene at that time lacked a dedicated national voice.
- The plant conservation sector encompassed at least five groups of stakeholders who at that time had limited cross-awareness and communication. These were conservation managers (largely in government agencies), conservation scientists (agencies and universities); community native plant enthusiasts (with both horticultural and ‘wild’ interests, the latter including the bush regeneration sector), and a potentially large but disparate body of land managers who might be brought into the plant conservation fold (from the mining, agricultural, and other tenures). Could a national NGO broker links between these groups?
- Australia’s federal structure, with conservation and land management vested mainly with the States and Territories, and a multiplicity of relevant agencies, tends to fragment communication and common effort. Could an NGO cut through some of that?

Also, some emerging areas of expertise and technique – notably translocation and germplasm conservation – were clearly (to us) going to be important in the future. What needs in the plant conservation sector could be left to existing agencies and NGOs, and what others were not being met – and not likely to be met – unless the new ANPC took them on?

At that time, there was in some quarters suspicion about *ex situ* conservation and translocation, at least for plants. These techniques were dismissed by some as respectively 'just gardening' and as 'playing god'. Plants were supposed to be able to look after themselves, at least once they were protected by a reserve boundary on a map. Such attitudes were less prevalent among the more hands-on agency people, especially those engaged with animal conservation, where a longer track record of zoo-based conservation and translocations had achieved legitimacy for these approaches. The antiquated views, inadvertently reinforced by the prominence of botanic gardens in the new ANPC, fed a lingering perception in some bureaucratic circles that ANPC had a primarily *ex situ* emphasis and was a 'special interest' group for the botanic gardens – this stuck to our shoe for a few years.

However, other sections of the environmental agencies did *not* take that view, and their active support of the new organisation was key to its survival. A central secretariat was funded partly by member fees and partly by the Commonwealth's Endangered Species Program, a unit of the then Australian Nature Conservation Agency (a statutory authority with more latitude for initiative than the later department). This support came without undue attempts to shape the role or voice of the organisation. The office was hosted, then as now, by the ANBG, which also assisted for some years with subventions of staff time.

While the '*ex situ*' tag never reflected the ANPC's full vision and scope of activity, an early project was the 'National Endangered Flora Collection', an ongoing catalogue of the holdings of threatened species in 42 public and private botanic gardens and other institutions around Australia. This built on earlier work by the ANBG. Further plans for the ANPC to coordinate the use of these collections for species recovery actions, and to build a comprehensive database for rare and threatened plants, were pursued for three or four years but did not eventuate, mainly because the government agencies themselves were rapidly becoming more active in both those areas, and because the scale of project-level activity and a database across jurisdictions were, it became evident, beyond our capabilities. Nevertheless, ANPC's ability to secure the cooperation of a wide range of institutional and non-government players around the catalogue, was demonstrated. This capacity to drive collaborative networking has been a hallmark of the ANPC ever since.

Choices had to be made by the early membership:

1. What was the role of the new organisation to be? What mix of advocacy, training, and information sharing should it take on?

Some early goals were either overtaken by new legislation and agency activities in which ANPC members were independently active (such as recovery planning, and the need to build lists of highly threatened species and vegetation types), or developments in other sectors (e.g., nursery accreditation). The ANPC's emphasis increasingly focussed on gap-filling, mainly in training, information transfer, and the development of best-practice guidelines.

There was a consensus that the ANPC should focus on an exchange of information and expertise, rather than be an advocacy or campaign group except in a general sense. It was felt by most that there were enough better-resourced advocacy campaign groups active on specific issues, but no-one filling the 'linkage and enablement' space, which necessarily involves a broad-front approach across many issues. The question of how much advocacy we should undertake has been revisited and reaffirmed several times by successive committees and AGMs, although a proportion of members in consultative polls over the years sometimes call for more. In practice, the ANPC has never given up its right to lobby or make critical public comment (see for example <https://www.anpc.asn.au/submissions/>) – but our main emphasis has been elsewhere.

Training was initially seen as the responsibility of member organisations, but it was soon accepted that the ANPC would itself be a vehicle for training activity. The first such event was a workshop for leaders of the study groups of the *Society for Growing Australian Plants* (now the *Australian Plants Society*).

2. How should the ANPC be organised? How could we foster the rather fragile links between members from science, community, and land management sectors?

The formal structure of the ANPC was at the earlier stage kept to a minimum, partly to enable government agencies to 'join' without too many bureaucratic complications. There was simply a membership (of organisations and individuals), a secretariat (one paid coordinator and volunteers), and an advisory committee. The Advisory Committee was established in 1992. Its core focus was to help develop and maintain co-operation between botanic gardens, community organisations, and the biodiversity agencies, and to advise on priority conservation activities and fund-raising options. The advisory committee included members from government, industry and NGOs relevant to both *in situ* and *ex situ* conservation. It was chaired by Professor Henry Nix.

The first national conference under the ANPC name was held in Tasmania in December 1993 and was themed “Cultivating Conservation – Integrated Plant Conservation for Australia”. By the time of this event, membership had increased to 170. As well as formally constituting the organisation, the Hobart conference identified a need for nationally applicable guidelines for *native plant germplasm capture and storage*, and for the *translocation of threatened species*. Cross-jurisdictional teams were formed for each of these themes, and they have been critical areas of the ANPC’s activity ever since. First editions of guidelines for each appeared in 1997, and were formally endorsed by the Standing Committee on Conservation of ANZECC (the Council of Australian and New Zealand environment and conservation Ministers). They rapidly became *de facto* best practice standards across Australia and helped guide an explosive growth of practice. We are now, in 2021, on our third editions of both sets of guidelines.

Membership grew to about 250 by 1995, in which year Jeanette Mill took over as National Coordinator (to 2003).

National conferences in the first twelve years were held in Hobart (1993), Perth (1995, adjunct to the congress of Botanic Gardens Conservation International), Coffs Harbour (1997), Albury (1999), and Geelong (2003). That we still exist today owes much to the support of local institutions for these events, and the organising work done by local people (often their employees) who volunteered – or were volunteered! – to make them happen. Personal links made at these events survive and help sustain us two decades later.

Four regional the ANPC groups were initiated by 1995 (Sydney, WA, Victoria, and subtropical NSW/Queensland), and others followed (including Tasmania, Illawarra/NSW South Coast, and NSW South-west Slopes). All regional groups were heavily dependent on their voluntary coordinators, who were mostly employees at agencies or institutions. The ANPC saw developing regional activities as an important goal, but supporting these coordinators from the very small Canberra-based secretariat was always a battle. Not all groups took root, and growth was slow. A major blow was the decision by the Commonwealth’s Endangered Species Advisory Committee’s Plant Working Group in 1998, that no funding be provided for the development of ANPC regional groups or training of volunteer regional coordinators. Some regional groups nevertheless stayed active for some years, notably the Sydney and SW Slopes groups. The Tasmanian group also survived but by a different means – it gradually morphed into the Botanical Guardians group and then merged into Wildcare, leaving ANPC with only a very small Tasmanian membership and presence after about 2000.

Training events in the first 12 years included some epic events of eight days (Canberra 1995), ten days (Tasmania

1998), and seven (Lismore 2001), all covering a suite of plant conservation techniques. These long courses were among only three such professionally oriented courses in the world at that time. However, the costs and effort involved, plus the difficulties of securing professional accreditation, and declining agency support for extended staff absences, were such that they were not continued, although the concept remains appealing.

Most domestic training events were 1–3 days in length, with a steadily growing number of workshops on both specialist topics (including translocation, seed banking, and conservation of remnant vegetation), and general issues (principles and ethics of plant conservation, plant identification, best information sources, ‘integrated’ conservation, and threat abatement).

We early made it a practice to take training to the regions, and to ensure that alongside the ‘portable’ content of each event there was a strong admixture of local experience in both content and presenters. This meant more work in organising, and a less standardised product, but post-event evaluations have consistently shown that this approach made for higher enrolments and a better take-home experience.

The ANPC contributed in this period to the development of overseas courses (e.g. the International Diploma in Botanic Garden Education), and ANPC personnel assisted with the establishment of plant conservation networks in other countries, notably New Zealand and Indonesia. The ANPC in the 1990s also maintained regular liaison with a few key overseas and international bodies, including the International Union for the Conservation of Nature’s (IUCN) Species Survival Commission; the Botanic Gardens Conservation International (BGCI); and the Center for Plant Conservation (CPC) at Missouri Botanical Garden, USA. These international connections atrophied after 2003, due to the need to focus on domestic priorities, but some interactions continued (especially with the NZ Plant Conservation Network) and have increased again in recent years.

Harder times: 1996–2003

By 1996–97, both the party and the mood of government had changed, with nearly all biodiversity grants being channeled through the new Natural Heritage Trust. NHT and departmental priorities emphasised process, short-term projects, work plans, and ‘on-ground results’, with very little space for linkage and expertise transfer. Commonwealth funding changed across the board, and in the following years many conservation initiatives and some whole organisations went to the wall. In 1997 and again in 2001, external reviews of ANPC activity were conducted, partly sought by us and partly required by the Commonwealth to validate what funds were still being provided. The 2001 review report (yet to be digitised and posted online) provides an excellent analysis of the ANPC and its history to that point.

These reviews were not unfriendly, the 2001 review stating that “The ANPC is playing a unique and valuable role in plant conservation training” and recommending continuing support (which did not eventuate). But they did not reverse the trend towards narrowly defined and project-only funding, and a perception that the ANPC was of uncertain relevance to the Commonwealth priorities of the day. These signals did not immediately result in an adequate re-orientation by ANPC to survive the new realities.

Coinciding with these issues, by the mid-1990s the informality of ANPC’s organisational structure and membership was becoming a liability in relation to external perceptions and the receipt of grants and other income. The Advisory Committee morphed in 1997 into a working party under the convenorship of Prof. Henry Nix, to urgently pursue incorporation of the ANPC. We became an Incorporated Association registered in the ACT in 1998, with Henry Nix’s *pro tem* presidential role passing to Dr Kingsley Dixon as the first President of the formally incorporated association.

The ANPC embarked on its second decade with growing pressures (financial and other) but with some greater structural rigour, and with the enthusiasm and energy of the membership intact – even if we had problems servicing them, particularly the regional groups, as well as we would have liked, and as a result were not retaining as many organisational members as we should have from year to year.

The pressures came to a crunch in 2002–3, with an acute financial bottleneck and a paralysis of response until the last minute, but in the event a ‘rebound’ strategy in 2004, refocussing on domestic priorities and strengths, and predicated on the energy of members and a gifted set of staff, got us through. We became more self-reliant, got better at preparing grant applications, and the financial base was broadened and diversified – although it has never been comfortably secure for the core activities that are not funded by grants. The story from 2003 onwards needs a separate article.

People and energy

Two things are missing from this account of the first dozen years of ANPC. One is a full tabulation of activity – how much was going on. This would be impressive but could take up several more pages.

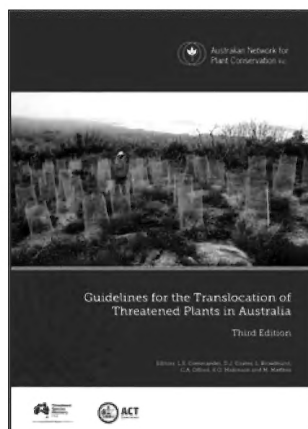
The other and most important missing element is names – all the people, some of them now passed, whose foresight and hard work – alongside all the other things they were doing – made our 30 year history possible. This too would be a very long list.

Both of these missing elements are best read in their context, and this is now being made possible by the online posting, with open access, of all past issues of *Danthonia* and *Australasian Plant Conservation*. It is worth browsing these issues in spare moments – the work they report remains fascinating, and a great many of the issues and ideas remain highly relevant in the 2020s. Information about accessing these issues can be found at: <https://www.anpc.asn.au/apc-index/>

Other historical material could be added to our website and if you have photographs of ANPC events and people that you are willing to share from any time in our history, please supply them in best-possible resolution and with as much supporting detail as you have. Email to anpc@anpc.asn.au with subject line ‘ANPC historical’.

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Retrospectives and perspectives on plant conservation in Australasia

Australasian Plant Conservation wrote to members of the plant conservation community, inviting short contributions on the themes:

“What were you doing in 1991 and what are you doing now? How things have changed in the past 30 years.” and/or “What are the past, current and emerging issues for plant (or biodiversity) conservation in Australia (or Australasia)?

The following short articles are arranged in no particular order and encompass reflections and wisdom. They demonstrate how things have changed – and that some things stay the same. Reading through these contributions I was overwhelmed by the breadth of experience and expertise contributing to the cause of plant conservation in Australasia. While we may not always be proud of Australia’s biodiversity conservation track record, there is hope for the future.

Heidi Zimmer
APC Editor



Heidi with *Telopea oreades* at Waratah Flat in Far East Gippsland, Victoria in 1993. Photo: John Zimmer

Stephen Bell

School of Environmental and Life Sciences, University of Newcastle

Eastcoast Flora Survey

One important future issue for plant conservation is how we manage rare and threatened taxa. We need to transition management of these entities from the species- to the landscape-level. Threatened species inevitably form part of a network with other biodiversity and abiotic elements of their habitat, and often focusing management on a single species also requires maintaining pollinator and dispersal networks, and habitat disturbance patterns. Current management strategies for some species are sometimes too focused and fail to also address the needs of co-occurring species and their habitat requirements. For example, are appropriate nesting sites for insect pollinators being retained in the immediate area of the target plant species? Is the low abundance of senescing adult plants of a soil-stored seed species related to a long absence of fire, and should we be concerned with no new recruitment? Is the abundance of terrestrial orchids found along the sides of bushland roads threatened by or because of the irregular ground disturbance created by maintenance? We also need to reintroduce and champion the concept of rarely seen species. There are numerous species that are rarely encountered in natural



Pterostylis chaetophora (Vulnerable) colonising road edges in Columbe National Park. Photo: Stephen Bell

systems, but these should not be considered threatened because they are rare. Threatened species legislation is peppered with wide-ranging, likely well-conserved rarely seen species, but not all of these are subject to real and active threats. Before listing a species represented by few records, we should research its ecology and likely population size and accept the reality that some species are just rarely seen.

Tony Auld

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University of Wollongong

Back in the early 1990s, I was actively involved with the NSW National Parks and Wildlife Service working on plant and ecosystem conservation in fire prone systems, investigating the lack of ongoing regeneration of a number of long-lived arid trees and working with a national team looking at the identification of threatened flora. Several colleagues and myself were just formulating concepts around thresholds of tolerance of plant species to high fire frequency and what fire management was required to minimise adverse impacts.

30 years later, a warming climate has brought new threats and exacerbated the existing ones. The fire threshold work has been embedded in NSW fire management planning for over a decade and is now seeing the consideration of updates to incorporate thresholds of impact that relate to other components of the fire regime (severity and season). Threatened species listing is based on best practice international guidelines that have been adopted across Australia (IUCN Red List species criteria), while some jurisdictions have also adopted IUCN Red List for ecosystems criteria.



Dead *Acacia carneorum* in dust storm in 2008. Photo: Tony Auld

Sadly, some things haven't really changed; clearing and loss of species habitats continues at too high a rate leading to more species becoming candidates for listing as threatened; while regeneration in many arid trees has not improved and domestic and feral grazers, drought and a warming climate bring the likelihood of decline and loss of a number of these keystone species. The conservation of plants remains relatively poorly funded compared to that of many vertebrates.

David Eldridge

School of Biological, Earth and Environmental Sciences,
University of NSW, Sydney

In 1991 I had been working with the NSW Soil Conservation Service for just over a decade, had spent a year in North Africa with the World Bank, and had just started a PhD. A federal government grant allowed me to start a four-year study of the ecology and management of biocrusts (cryptogams). This work took me all over the world, to Maralinga to investigate how biocrusts could stabilise nuclear waste dumps, and to run landholder (and ANPC) workshops all around Australia. The early '90s was a period of personal freedom, when governments placed more emphasis on science and scientific freedom, allowing us to pursue research agendas that we believed were important. Without this freedom, substantial ecological research would never have happened. We were also trusted to engage with the media, unlike today when everything is managed. I had stints on *Totally Wild* and *Burke's Backyard*, and a trip to the Great Victoria Desert to record *Australia All Over*. Senior managers in my agency allowed me to work in a university environment, which was beneficial to everyone. A major legacy of those working in the late '80s and early '90s was that we amassed a huge repository of ecological data. With new statistical methods, and faster computers, we are only now realising the true economic and ecological value of these large datasets that tell us so much about the health of Australia's ecosystems nearly half a century ago.



Assessing the impacts of shrub removal on erosion at 'Bloodwood' north-west of Bourke early 1992. Photo: David Robson

Emma Bodley

Auckland Botanic Gardens

In 1991, I was only a baby smelling flowers and crawling around our home garden but by 1992 I had my first connection with Auckland Botanic Gardens. I explored the camellia garden with my cousin and had a photo outside the library/visitor centre (Fig. 1). Little did my mum know, that one day that would be my office and a place where I found my dream job. Throughout my childhood I was exposed to nature and the environment with holidays to natural areas and offshore islands and naturally I picked subjects at school and university that focused on environmental and ecological topics. I have now been working at Auckland Botanic Gardens for almost 8 years and I am involved in threatened plant recovery projects, seed collection and propagation research aiming to conserve plants of Auckland and eventually return them to the wild (Fig. 2). Working at a botanic garden is a fantastic place to advocate for the plight of threatened plants and empower our visitors to do the same, as well as value plants in their everyday lives. Plants are used to solve many of our challenges like bioremediation and water filtration, but we still need to overcome plant blindness to propel plant conservation forward and make the strides that animal conservation has made. It's time to be bold and ambitious with plant conservation and give plants the funding, governance and appreciation they deserve.

Margaret Byrne

Biodiversity and Conservation Science, Department of Biodiversity, Conservation and Attractions, Western Australia.

Plant conservation – 30 years of genetics and genomics

Population genetics has provided significant understanding and knowledge to inform plant conservation over many years, and conservation genetics is now well integrated into plant conservation practices. Genetic studies have demonstrated many unexpected insights into our Australian plants that are critical to inform conservation. Genetic diversity and differentiation is fundamental to managing rare and threatened species, particularly in fragmented landscapes and in an ancient flora. Genetics is integral to planning translocations and restoration, resolving species complexes and identifying cryptic species, understanding gene flow and population connectivity, identifying clonality and hybridity, determining mating systems to understand population dynamics, and understanding evolutionary history.



Figure 1. Emma, aged 2, visiting Auckland Botanic Gardens and hanging outside the visitors centre and library. Photo: D. Bodley



Figure 2. Working at Auckland Botanic Gardens on the conservation of *Pimelea eremitica*, a threatened species found in the northern part of New Zealand. Photo: R. Stanley



Genetics studies have contributed to conservation of many eucalypt species through understanding hybridisation, clonality, mating system, gene flow and adaptation, and identifying cryptic species. Photo: Margaret Byrne

The advances of genomics in recent years mean we now have even greater power in genetic data to inform conservation actions. In addition, this greater power provides opportunities to investigate areas we couldn't do effectively previously, such as adaptation to climate change, which is critical to develop strategies for responding to changing conditions, and understanding effects of inbreeding depression and dynamics of small populations.

In 1991 applications of genetics in plant conservation in Australia were just beginning to be understood. In the 30 years since then we have seen great advances in the sophistication of molecular techniques and in the expansion of applications to plant conservation (Byrne 2018). Now in 2021 we are routinely applying genomics techniques to our plant conservation challenges. You can access much more information on genomics and applications to conservation in the book *Conservation and the Genomics of Populations* (Allendorf *et al.* 2022) that is being published by Oxford University Press very soon. It clearly articulates the fantastic opportunities for applying genomics to plant conservation.

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Peter Bridgewater

Institute of Applied Ecology, University of Canberra

Four future challenges

30 years goes quickly. ANPC predates the Convention on Biological Diversity by a year. And reaches its 30th as the UN declares a Decade of Ecosystem Restoration. So, what of the next 30 years? Extinction will continue to be an issue. And sometimes species' traits cloud our understanding of a species' conservation needs. To take an animal example, *Pseudomys novaehollandiae* (New Holland Mouse), was "extinct" for 100 years, being rediscovered in the 1960s. Now it is well-known across the southeast and Tasmania, but its habitat choices are fickle and fire-related, making our knowledge uncertain. The accompanying photo of *Reedia spathacea*, a curious Cyperaceae from extreme Southwest WA, is listed as critically endangered, although we do not really know *how* critically.

It is possible to conserve all the species with which we now live. But not necessarily in the "wild", given the continuing diminution of wildness (note lack of -er after the d). The flexibility in ANPC using *ex-situ* to *in-situ* conservation approaches to repairing existing ecosystems under pressure from global changes, is its strength. Like community-based Landcare, ANPC is the only way forward for plant conservation – governments simply can't cope!

Four challenges loom large for the future – how to

- Deal with increasing plant diseases (think Myrtle Rust, *Phytophthora*).
- Improve our knowledge of species distribution and ecology.
- Embrace ecological novelty (see APC **24(4)**: 27-28).
- Forge better links with Aboriginal and local knowledge.

Fix these and the future of Australia's plant biodiversity is assured.



Reedia spathacea, a critically endangered Cyperaceae, (with a slightly younger author), D'Entrecasteaux National Park Western Australia. Photo: Ian D. Cresswell

David Coates

In 1991, as a research scientist in the then Department of Conservation and Land Management in Western Australia, I attended the inaugural ANPC Conference "Protective Custody? *Ex situ* Plant Conservation in Australasia". At that time my research and plant conservation activities focussed on *in situ* conservation dealing with a range of threatening processes including habitat loss and *Phytophthora* dieback. The conference opened my eyes to the value of *ex situ* conservation and the possibility of establishing populations of threatened plants through translocations. It was also becoming increasingly clear, with the local extinction of a number of threatened plants due to *Phytophthora* dieback, that *ex situ* conservation approaches were needed. In 1993, with assistance from Maurice McDonald, the threatened plant seed bank was established in the department. Anne Cochrane subsequently joined as Manager with Andrew Crawford recently taking over from Anne. A few years later Leonie Monks joined the Department to establish a program focussing on translocations of threatened plants which, combined with the newly established seedbank, paved the way for the integration of *ex situ* and *in situ* approaches across the agency that exists today. At the same time my research has continued to focus on the use of genetics in assessing and managing small declining plant populations, and more recently translocations. The move, over the last 30yrs, from allozymes to DNA based markers culminating in the current technical and analytical tools of genomics has revolutionised the use of genetics in conservation.



Banksia brownii was one of the first threatened species in WA to be targeted for seed collection in 1987 prior to the local extinction of the east Stirling montane populations due to *Phytophthora* dieback. These seed collections have subsequently been used in translocations and genetic studies. Photo: Dave Coates

We now have unprecedented resolution of patterns of genetic variation within populations and species to assist in a range of activities such as translocations, small population management and ecological restoration.

Bob Debus

It was one of the great pleasures of my professional life to have held responsibility for the Ministerial portfolio that included the great scientific and cultural institutions of the State of New South Wales for the second quarter of the 30-year history of the Australian Network for Plant Conservation.

That was a time, in the early 2000s, when early rounds of uncommonly severe bushfires and problems of dieback were causing some sections of the general public to better understand what botanists and other scientists were already so acutely aware of – the climate was changing and a growing proportion of endemic species were potentially at risk. Now the awareness is greater but the threats have rapidly become worse – and the crisis of changing climate and the crisis of biodiversity are understood to be closely intertwined.

The move away from fossil fuel is critical for the achievement of necessary emissions reduction in the next thirty years but it is unlikely on its own to be enough. We also need so called 'natural solutions' for the reduction of atmospheric carbon. The preservation and restoration of our unique and increasingly vulnerable Australian ecosystems is necessary for the indispensable contribution it can make to the abatement of climate change.

That kind of conservation work can only be effective at the necessary scale if scientists and practitioners use the best available research and collaborate across jurisdictions and disciplines exactly in the manner that ANPC has been set up to promote.

So on the occasion of its thirtieth anniversary ANPC and the community practitioners and world class scientists who make up its membership are more important than they have ever been at any previous time in its history.



Photo: Bob Debus

Mark Brundrett

Biological Sciences, the University of Western Australia (UWA) and the West Australian Herbarium

30 years of research on conservation and restoration in WA

In 1991 I was studying mycorrhizas in natural habitats and mines in Kakadu, while based at UWA. I arrived there two years earlier to work with a highly respected team led by Profs. Lyn Abbott and Alan Robson after finishing my PhD in Canada. Subsequent projects included a CSIRO-China collaboration on eucalypt plantations, managing rare wheatbelt orchids with community groups and banksia woodland restoration. I developed efficient methods for detecting mycorrhizal fungi, restoring habitats and propagating orchids. I also wrote an orchid guide that explains their ecology.

I am now a volunteer researcher on orchid pollination, genetics, conservation and taxonomy. This includes a genetic study of the *Thelymitra variegata* group led by Drs. Katharina Nargara and Lars Nauheimer (Australian Tropical Herbarium) and Mark Clements and Heidi Zimmer (National Herbarium). My research also includes resolving the global importance of mycorrhizal associations and plant traits such as fire responses.



Examples of plants sampled for the *Thelymitra variegata* Genomics for Australian Plants project. Photos: Mark Brundrett

My top seven emerging issues for plant conservation in WA are:

1. Ecosystem restoration is very difficult and often fails to recreate specific plant communities.
2. Mycorrhizal fungi take decades to recover in new habitats.
3. Rare orchid monitoring needs to include vital statistics such as pollination measured in fixed areas.
4. Orchids can have very low rates of pollination, especially in large groups.
5. Rare orchids face increasing threats and diminishing resources for their recovery.
6. Volunteers make major contributions but need better support and coordination.
7. Many orchid taxa are very similar to others and their identification can be inconsistent.

Rachael Gallagher

Hawkesbury Institute for the Environment,
Western Sydney University

In 1991, I'd just started at high school and founded the 'Environment Club' with my first group of like-minded plant enthusiasts. The most important development in conservation since this time has surely been the explosion of resources now available to scientists (amateur and professional) for understanding the Australian flora. In this time, we've digitised the information from millions of herbarium specimens, created major bioinformatics platforms to deliver datasets and information to any user, sequenced the genomes of thousands of species, and catalogued over a million observations of Australian plant traits. We can now take on continental scale analyses which would have been truly incredible to Banks and Solander.

With this in mind, I believe the greatest current and emerging challenge for plant conservation is how to fully integrate this wealth of data into threat assessment, management and monitoring. Despite having access to these vast resources, we need people – in permanent and valued positions in government, industry and academia – with the skills to turn data into knowledge. Crises such as the 2019–2020 bushfire season demonstrated how we can mobilise resources on the traits and geographic ranges of species alongside threat mapping to assess plants and ecosystems systematically across Australia. Given the hyper-diversity of our national flora (some 26,000 species) and the vast scales of our landscapes, the task of systematically assessing and ultimately protecting plants in Australia is immense. We need to invest in people – not just infrastructure – to prevent plant species being overlooked in the national conversation around threatened species and conservation.

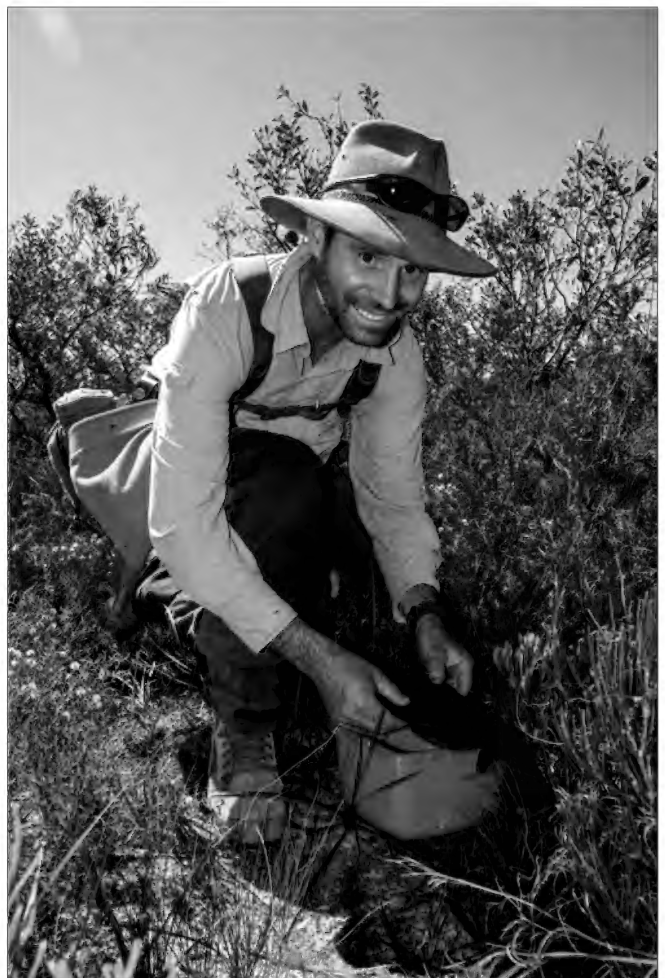


Training the next generation of Australian plant scientists (L-R: Matthew Alfonzetti, Sophie Moore and Ruby Stephens working hard on a drizzly day in the field at Strickland State Forest in Narara, NSW). Photos: Rachael Gallagher

Andrew Crawford

Biodiversity and Conservation Science, Department of Biodiversity, Conservation and Attractions, Western Australia

When the ANPC was established in 1991 I was undertaking an undergraduate degree in Horticultural Science. More significantly, I would be returning for my third season of commercial seed collecting. This balance of academic knowledge and practical seed collecting skills would stand me in good stead for my future career. Fast forward ten years and I started working for the then Department of Conservation and Land Management (now the Department of Biodiversity, Conservation and Attractions) at Western Australia's conservation seed bank, the Threatened Flora Seed Centre (TFSC), which now forms part of the Western Australian Seed Centre. I was employed to undertake seed conservation work as part of the Millennium Seed Bank Project (MSBP), a global effort to conserve seed led by the Royal Botanic Gardens, Kew. When I started, there were few conservation seed banks in Australia. Thanks largely to the MSBP, every Australian state and territory now has a conservation seed bank. With so many agencies across Australia involved with the MSBP, the Australian Seed Conservation and Research (AuSCaR) network was formed. This network has matured into the Australian Seed Bank Partnership (ASBP) which has strong ties to the ANPC and has been closely involved with ANPC projects such as the revision of the Germplasm Guidelines. These guidelines have aided in the improvement of the standard of seed banks across Australia so the collections they hold are no longer just seed, but high quality, representative seed samples that are actively being used to recover threatened species.



Andrew seed collecting in Fitzgerald River National Park. Photo: Andrew Crawford

Dr Paul Gibson-Roy

Restoration Ecologist

In 1991 I was studying environmental horticulture at Burnley College (Melbourne University). This set me on a path focused on the restoration of grassland and grassy woodlands. At that time the main issue regarding this vegetation was characterising their extensive decline and lobbying for legislation changes to ensure the protection of what remained. Little credence was given to the notion they could be reconstructed through ecological restoration. However, given that in Australia's highly cleared arable landscapes there is often little native vegetation left to conserve, over ensuing years small groups of people began to seriously investigate techniques and approaches that might make their return through restoration possible. Now, 30-years on the great achievement of those groups is that they have provided numerous small-scale (1 ha +) demonstrations that species and functionally rich grassy communities can in fact be restored (and maintained in those states). Sadly, 30-years on, the countering great disappointment is that conservation-focussed legislation has failed to prevent their continuing loss. There has been little support from governments or their agencies to develop policy, programs or sector capacity that would see their restoration occur at landscape scale (at the same time decades-long support of simplistic tree and shrub plantings continues). On reflection I rejoice grasslands

and grassy woodlands do not have to disappear – as a society we have the knowledge and capacity to restore them to the extent we see fit. Also on reflection, I bemoan that we have failed to make this happen.

Mark Ooi

Centre for Ecosystem Science
School of Biological, Earth and Environmental Sciences
University of NSW, Sydney

In the 1990s, I was completing a new degree course at the University of Wollongong, a Bachelor of Environmental Science, and also travelling and surfing as much as I could. At the time, the idea of focusing a degree on the environment and conservation, was relatively novel – even the term 'biodiversity' was only just beginning to gain traction after the United Nations Earth Summit in Rio in 1992.

As I was grappling my way through courses, taking in Rob Whelan's lectures on fire ecology and trying to understand the concepts behind biological diversity and conservation management, I think the rest of society was on a similar path. There seemed to be a shift towards a global effort to clean up the environment. As an example, at that same Rio Earth Summit in 1992, they also established the Climate Change Convention, a treaty established to encourage research into human impacts on the climate and ways to mitigate developing threats.



A wonderful 12-year-old roadside grassland restoration in SW-Victoria featuring beautiful and rare native wildflowers. Photo: Chris Findlay

Thirty years on, after forays into other work and lots of travel, I am now an academic at UNSW, researching fire, climate change and plant ecology, and giving the occasional fire ecology lecture. I think that a key indicator of how things have changed is that nearly every university now has conservation and ecology as a core part of their science curriculum and a regular intake of keen students. But in other ways, change has been slow, and we are still struggling with ways to address global issues like climate change.



Mark on an ecology field trip to Kioloa, NSW in 1991.
Photo: Rob Whelan



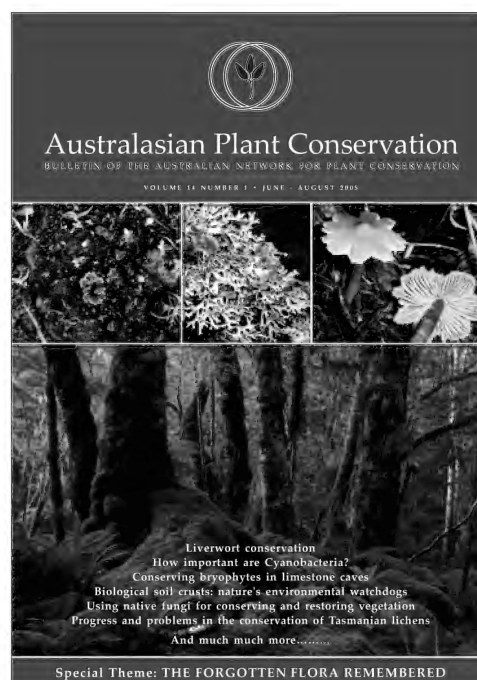
At a prescribed burn in the Noosa region in 2019.
Photo: Justin Collette

Tom May

Royal Botanic Gardens Victoria

My involvement with ANPC began in 1999 when I ran a workshop on fungi at the 4th National Conference in Albury-Wodonga. As participants sat around looking at fungi photos, I remember being struck by the thought that some had never had the chance to share their interest in fungi with like-minded people. I'd helped to start Fungimap a few years earlier, as a mapping scheme, but my experience at the workshop emphasised the need to link people as well as collect data. Fungimap went on to hold successful national and regional events, and fungal study groups have sprung up across Australia.

From 2006 to 2008 I edited *Australasian Plant Conservation*. I enjoyed being in touch with contributors from all around Australia, sharing successes and challenges in plant conservation. Personal highlights were special issues such as "The forgotten flora remembered" and helping organise the 2007 ANPC Forum on soil biota "What lies beneath".



Cover of "The forgotten flora remembered" special issue of APC, 2005.

Lately, I've been thinking about how we tackle conservation of groups such as algae, bryophytes and fungi. For too long, these critical components of the biota have been put at the back of the queue, due to perceptions of a lack of knowledge and people. This "serial" approach reinforces the lack of resources and stifles progress. A better strategy is to work on all biota, in parallel, in ways appropriate to the state of knowledge. After all, ecosystems are complex interactions among numerous species. As an example, I'd like to see "spore banks" to complement seed banks as a key measure for *ex situ* conservation of fungi — and something to get started on now, rather than waiting until all plants are banked.

Suzanne Prober

Land and Water, CSIRO, Floreat, WA

In August 1991 I stopped outside a country cemetery near Young in New South Wales and noticed a field of golden yam daisies (*Microseris walteri*) and buttercups (*Ranunculus pachycarpus*) blooming in the early morning sunlight. I'd been searching for more than a year for a site like this, living evidence of the pre-European plant diversity and composition in the widespread White box (*Eucalyptus albens*) woodlands of south-eastern Australia. A closer look revealed a diversity of species rarely found within the agricultural landscapes outside this ungrazed sanctuary. Over the next two years I visited nearly every cemetery on the NSW western slopes, as well as many Travelling Stock Reserves, roadsides and back paddocks, to piece together the ecological story of these woodlands.

Since then I've been fortunate to have been involved in an inspiring wave of commitment to the conservation of temperate eucalypt woodlands in agricultural landscapes, including a burgeoning of ecological research, the listing of these woodlands as a threatened ecological community, growing engagement with First Nations people, and the development of new policies for their conservation. The latter include Conservation Management Networks, revegetation and fencing programs, the birth of Australia's regional NRM system, and Australia's first Environmental Stewardship Program.

I'm still involved in research in these woodlands today, unlocking the secrets that help us understand how to restore and manage them. Alongside this I've had the pleasure to work in Australia's largest remaining temperate eucalypt woodlands, the Great Western Woodlands in south-western Australia,



Dr Suzanne Prober and Dr Ian Lunt researching the restoration of the native ground layer in a white box woodland landscape, Murrungo NSW. Image: Margaret Beemster

where intact woodlands stretch from horizon to horizon. But I've also seen the immense scars created by increasing landscape-scale, intense fires in these woodlands in recent years, an early taste of the climate change impacts we can expect in ecosystems around the world. This looming threat has led to another of my research foci – rethinking nature conservation in a changing climate and helping biodiversity adapt.

Brett Summerell

Director Research and Chief Botanist
Australian Institute of Botanical Science
Royal Botanic Gardens and Domain Trust, Sydney

In the past 30 years we have seen a revolution in the capacity of plant science to understand plants and ecosystems, and the threatening processes affecting them, at both a macro and microscale. Technological advances in computer modelling and analysis and in gene and genomic analysis allows us to now better understand not only the impacts on species, but also on the genetic diversity present in ecosystems and how to conserve them more effectively. The questions we can now address really have made it a wonderful time to do conservation science, and to provide answers to the most pressing problems affecting plant survival.



Brett at Mt Tomah Spur at the Blue Mountains Botanic Garden, Mt Tomah. Photo: Brett Summerell

Unfortunately, over that time we have seen and experienced an escalation in the negative impacts of humanity on the natural world. The impacts of climate change, land clearing and from my own research perspective, invasive species, continues to rise. Invasive plant diseases like *Phytophthora* root rot and myrtle rust have either become more recognised and prominent or introduced into Australia with devastating effects on the survival of at-risk species. The response needed to manage such problems is complex and multifaceted, but encouragingly we are starting to see action involving a diverse community of scientists and concerned individuals.

It would be easy to be despondent, as the task is immense, but I am continually heartened by the way in which this community continues to collaborate in the face of some resistance. The role of ANPC in co-ordinating and supporting these responses has been critical and we would be much poorer without their work over the past 30 years.

Angela T Moles

Evolution and Ecology Research Centre, University of NSW, Sydney

Conservation in a dynamic world

The last 30 years have seen a dramatic advance in understanding of how quickly ecosystems and their component species can change. Plant species' ranges are shifting poleward or uphill at an astonishing rate, and the timing of biological events such as flowering are advancing substantially (Fitter and Fitter 2002; Parmesan and Yohe 2003).

The shifting ranges of species, and the associated changes in interactions between taxa resulting from coexisting with a different suite of competing plants, pollinators, herbivores and pathogens (e.g., Robbirt *et al.* 2014) likely impose strong selective pressures on our plant species. Which brings me to another advance: we have gone from thinking that evolution occurs over geological timeframes to having many examples of plants undergoing evolutionary change within years or decades (e.g., Williams, Kendall and Levine 2016; Everingham *et al.* 2021; Figure 1).

All this change could be seen as good news, as it gives us hope that our beautiful native species and ecosystems will be able to adapt and shift to persist in the face of change. However, while we might celebrate the fact that our favourite threatened native species are able to survive climate change by moving upslope or poleward, we might simultaneously be dismayed when our favourite ecosystem is colonised by native species from warmer regions.

Much of our conservation policy in Australasia aims to keep ecosystems in a state as close as possible to their pre-European condition. However, this goal is becoming increasingly unattainable in the face of climate change, species' introductions and other anthropogenic pressures. It seems to me that we will be able to retain more of our native species and ecosystem function by allowing species to shift and communities to reassemble than by trying to hold back the tide. Managing ecosystems in flux is going to require changes in our approach and legislation that are almost as dramatic as the changes our species are facing.

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Figure 1. *Arctotheca populifolia* was introduced from South Africa to Australia in the 1930s. There are now substantial, heritable differences in morphology, phenology, physiology and reproductive biology between the Australian and South African populations (Brandenburger 2019).

Jen Silcock

School of Biological Sciences, Faculty of Science,
University of Queensland and Queensland Herbarium

October 1991. I was nearing the end of Grade 2 at Pittsworth State Primary School on the eastern Darling Downs, Queensland. Sitting in a hot country classroom, unaware of the rare and endangered grassland forbs quietly living their lives in small remnants amongst the agricultural fields and woodland hills that stretched beyond the edge of town. I would remain unaware for more than a decade, despite doing some local assignments for geography and being dragged around bushland reserves by my Landcare-ing dad.

October 2021. Sitting at my kitchen table in western Queensland, writing these reflections while my toddler sleeps. In the past 15 years, I've spent hundreds of hours exploring and researching those grassland remnants around my hometown. I now know that they harbour a remarkable suite of endangered plant species, and represent the last stronghold for some that have become extinct in southern states. My observations and repeat measurements clearly show that these remnants are slowly being eroded in a classic 'death by a thousand cuts' scenario. A bit of slashing here, some weedy grasses there and the odd spot of opportunistic grazing. Across the valley, some peri-urban expansion and a road-realignment.

This to me represents perhaps the major issue for plant conservation in Australia. Other big issues for plant conservation get a lot more airtime, for example myrtle rust and *Phytophthora*, and broadscale landclearing. However this insidious loss and degradation of small remnants in already fragmented agricultural and urban landscapes – through edge effects, the inertia of rampaging weeds, unwitting destruction, lack of care and protection – will perhaps result in the biggest long-term loss of species and examples of ecosystems in eastern and southern Australia.

I want my son to be able to experience the subtle beauty of Australia's only native thistle, *Rhaponticum australe*, and sit under a gnarled mountain coolabah at sunset and feel the magic of the downs – home to hundreds of generations of Giabal families – before agriculture razed their productive blacksoils. These remnants, like hundreds of others across Australia, will only survive if they have local champions to look out, advocate and care for them. Maybe school curricula that include introductions to local species, ecosystems and natural history are part of the solution.



Flowerhead of *Rhaponticum australe*, Australia's only native thistle, first collected by Mueller in 1854 but now considered extinct in Victoria and New South Wales. Photo: Don Butler



Mountain coolibah (*Eucalyptus orgadophila*) on hill behind Pittsworth township. Photo: Jen Silcock

Leonie Monks

Biodiversity and Conservation Science, Department of Biodiversity, Conservation and Attractions, Kensington, Western Australia.

In 1991 I started my tertiary education in a broad-based Bachelor of Science in Biology. As I progressed through my degree I increasingly focused on units about plants and conservation and eventually completed an honours and masters project in plant conservation. This interest in Australian plant conservation led to my current job as a Research Scientist with the WA Department of Biodiversity, Conservation and Attractions (DBCA), where my research focus is on improving the success of threatened plant translocations. When I started at DBCA (or CALM as it was known then) in the late 1990s, translocations were a relatively new idea, with only a limited number having been undertaken in Australia. These early translocations had often been conducted to mitigate for population loss due to development or had been undertaken on an ad hoc basis with little thought about the long-term prospects of the plants. Whilst mitigation-type translocations are still occurring, now more frequently translocations are undertaken to conserve and recover species as threats such as salinity, habitat degradation, diseases (e.g., Myrtle Rust and *Phytophthora* dieback) and more recently climate change are increasing. With the increased translocation activity and with the publication of guidelines such as ANPC's Guidelines for Threatened Plants in Australia and the synthesis and publication of past translocation work (e.g., Silcock *et al.* 2019) much has been learnt to improve success rates. Today, there is a much better understanding of the need to carefully plan and implement translocations to better contribute to the conservation of a species.



Leonie Monks at translocation site for *Chorizema humile*.
Photo: Benson Todd/DBCA

Amelia J. Martyn Yenson

Australian Network for Plant Conservation
The Australian PlantBank, Australian Institute of Botanical Science,
Australian Botanic Garden, Mount Annan NSW 2567, Australia

In 1991, I was thirteen and already enamoured with plants. My family went on picnics and bush walks in the Royal National Park and enjoyed David Attenborough documentaries and the new ABC show 'Gardening Australia'. Family holidays usually involved a trip to a bush block owned by the late Dr Surrey Jacobs, a family friend and botanist at the Royal Botanic Gardens, and his wife Betty. Further afield, we camped at the inland dams of NSW, including Keepit, Burrendong, Wyangala and Burrinjuck. The photo below was taken at Burrendong Arboretum on one such trip. I was aware of the greenhouse effect and global warming but much more interested in pretty plants especially Australian species, and their diversity of form, colour and scent.

Fast forward 30 years and I now have three children who recognise plants and enjoy bushwalks but have many interests of their own. They are more keenly aware of the world around them than I was at their age. They worry about their environmental future, particularly the decisions that adults are taking on their behalf. I often use examples from my work at ANPC and the Australian PlantBank to show them that many adults devote their lives to studying and protecting plants, habitats and their global future.

It is my privilege to work for ANPC and help amplify the reach of the important work happening in seed banks, botanic gardens and labs, as I learn more about restoration and translocation projects. Here's to a bright future for ANPC, promoting lifelong learning and collaboration in the challenging years ahead.



Amelia in the Fern Gully at Burrendong Arboretum, January 1992.
Photo: Greg Martyn

Damian Wrigley

National Coordinator, Australian Seed Bank Partnership
National Focal Point, Global Strategy for Plant Conservation
Oceania Representative to the CITES Plants Committee

In 1991 I was 10 years old and visiting Kings Park and the Perth Zoo on weekends with friends. I dreamed of growing up to work with 'nature' and now I'm living that dream. I count myself lucky to be working with incredible people from all over the world to conserve native plants and their associated ecosystems.

For me the most pressing issues that plants have faced for a long time now are anthropogenic influences on the places they inhabit. Sadly, this now encompasses the entire planet. With rampant changes in land use, increased globalisation moving pollution, pests and disease to new areas and the increasingly serious impacts of climate change, plants more than ever need our help. Despite these pressures I have hope for the future. I see so much opportunity in the networks and partnerships we foster and maintain both in Australia and overseas. By making our knowledge and expertise available and working collaboratively to secure and share resources we can continue achieving positive outcomes together – far more than we could do working alone.

I want to offer a huge congratulations to the ANPC and all those who have contributed to the organisation over

30 years. Your work has been so influential and it is great to see that influence continue to flourish. Australia's lucky to have so many dedicated experts working towards a common goal of conserving our native plants and sharing that knowledge with our Australasian neighbours.

Alison Shapcott

University of the Sunshine Coast, Queensland

In 1991 I was working with the Tasmanian Parks Wildlife and Heritage employed under the National Rainforest Conservation Program and I had just published a technical report on the Population Biology and Genetic Variation of Huon Pine (*Lagarostrobos franklinii*) which was to later become part of my PhD (University of Tasmania). This was to be one of the earliest conservation genetics studies published in Australia, a field that blossomed over the next 30 years. Since that time I have continued to integrate strong field based population ecology with genetics to address conservation and restoration of Australian plants with nearly 40 species studied to date. The genetic markers have changed over time and the emergence of spatial analysis, modelling and mapping tools has revolutionised the study opportunities. Perhaps the biggest change has been the shift in focus from conservation to restoration.



I think I've convinced at least one of my kids to pursue a career in plant conservation – it'll be his generation that needs to continue our work! Photo: Damien Wrigley



Alison undertaking fieldwork, with Huon pine in background, about 30 years ago. Supplied: Alison Shapcott.

News from the Australian Seed Bank Partnership

Australasian Seed Science Conference 2021: *Linking seeds with needs; securing our future in a changing world*

CATHY OFFORD¹, SAL NORTON², LYDIA GUJA³ AND DAMIAN WRIGLEY^{4*}

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The Australasian Seed Science Conference 2021 was hosted by the Australian National Botanic Gardens, Canberra, as a global virtual event from 6th-10th September 2021 with 425 delegates from 34 countries. This international meeting followed on from the National Seed Science Forum of 2016 and presented the latest advances in seed science across the conservation and agricultural sectors. The conference was delivered across four key themes with two days of plenary and three days of workshops.

The Partnership would like to acknowledge the support of our partners and sponsors as well as our Organising and Scientific Committees, special guests and delegates for helping to make the conference an important opportunity for collaboration across the conservation and agricultural seed sectors in Australia and overseas.



Delegate 'photo' from the virtual Australasian Seed Science Conference 2021. Photo: ASBP

The Authors would also like to acknowledge the ASSC 2021 Scientific and Organising Committees for their efforts to synthesise the vast amount of information presented throughout the various conference sessions.

1. **Seed biology and evolutionary ecology** – *Unlocking the challenges of germination, dormancy and seed ecology in a changing world.*
2. **Seed sourcing and end-use** – *Considering genetic diversity, restoration and translocations as well as sector specific approaches to seed conservation and use.*
3. **Seed and gene bank management** – *The ins and outs of managing ex situ seed banks and gene banks and the methods for maximising seed quality and longevity.*
4. **Seeds in culture and society** – *Sharing stories and learning about historical, socio-cultural, and legal practices of seed conservation, use, exchange, and repatriation, including collaborations between traditional use, community, and ex situ seed banks and gene banks.*

Theme 1 – Seed Biology and Evolutionary Ecology

Our first theme for the conference was chaired by Prof. Adrienne Nicotra and welcomed 24 authors including the Keynote speaker Dr Si Chong Chen from the Millennium Seed Bank of the Royal Botanic Gardens, Kew. Dr Chen looked at biomass allocation across seed and diaspore functional components, presenting the findings from intraspecific and interspecific studies, improving the available knowledge of the variation of seed functional components. Dr Chen's findings suggest that smaller seeds invest proportionally more biomass in protective tissues than do larger seeds, a finding that agrees with traditional ideas that some small seeds may have advantages in physical defence. Studies such as this are important for improving our collective understanding of plant reproductive strategies.

The following 23 talks and posters in this theme demonstrated how the study of seed traits is contributing to our understanding of plants' reproductive strategies and how these are driving species distribution under

climate change, as well as how to manage species from other threats such as increased fire severity and frequency. Several studies highlighted understudied but clearly important areas such as the role of ploidy in seed germination and the understanding of the seed microbiome. This area is relatively well understood in the agricultural sector, but less so in the conservation and restoration sector, making this an exciting emerging theme for many seed scientists.

Theme 2 – Seed Sourcing and End Use

The second session was chaired by Dr David Merritt from the Western Australian Seed Centre, Kings Park and welcomed Prof. Robert Henry from the University of Queensland as the Keynote speaker. Prof. Henry outlined rapid recent advances in genome analysis technologies that are allowing for the application of genomic analysis to the collection and use of genetic resources. This technology will become increasingly important to the rapid identification of the genetic and molecular basis of important plant traits, and greatly enhance our ability to manipulate these traits in breeding and production, both in the conservation and utilization of Australian plant resources in crop improvement and climate adaptation. A major take home message from Prof. Henry's Keynote was his recommendation that seed scientists commit to sequencing the genome of all species. Prioritising the sequencing of the genome of all native species will deliver substantial knowledge gains from a relatively small per-species investment. Later in the session Dr Marlien van der Merwe from the Australian Institute of Botanical Science highlighted the application of genome sequencing to inform seed sampling strategies for capturing species' genetic diversity,

and recommended prioritising separate maternal line collections to enable further investigative studies.

Other emerging themes from the following 14 presentations included the development of a seed industry accreditation scheme in Western Australia by the Revegetation Industry Association of Western Australia and how a similar scheme might be achieved across Australia. Also included in this theme were papers that referenced the emergence of science and practice-based guidelines like the recently revised Florabank Guidelines and the Plant Germplasm Conservation in Australia guidelines (Germplasm Guidelines), best-practice guidelines produced by the Australian Network for Plant Conservation. Other presentations in this theme gave examples of collaboration and sharing between seed banks, and the promisingly large-scale restoration occurring in various parts of Australia and Cambodia. Authors reiterated the importance of not only producing large amounts of seeds that will germinate and establish, but also to greatly increase the diversity of species that are available for restoration projects.

Theme 3 – Seed and Gene Bank Management

Theme 3 was chaired by Dr David Bush from the Australian Tree Seed Centre at CSIRO Black Mountain. Dr Bush welcomed Dr Sal Norton who provided an insight into the workings of the Australian Grains Genebank in Horsham Victoria, and Dr Elinor Breman who presented a complementary perspective on the inner workings of the Millennium Seed Bank of the Royal Botanic Gardens, Kew. These Keynotes provided delegates with an opportunity to compare the common and differing purposes of gene and seed banks, challenging all of us to explore how facilities such as these can learn from each other. Theme 3 continued to provide delegates with an opportunity to compare and appreciate the diversity of gene and seed banks, including their multiple purposes from across the Australasian region and further afield, including Indonesia, Singapore, Thailand, Malaysia, China, Japan and Syria.

Further papers presented in Theme 3 revealed the increased effort dedicated to the implementation of cryopreservation for exceptional species, highlighting that it is now possible for seed scientists to start implementing cryostorage for the germplasm of many species. Other papers stressed how critical it is to continue investigating the storage requirements for poorly understood species. Additional technological advances presented include research that improved the understanding of factors that relate to poor seed storage behaviour, and the development of a predictor key that can be used to determine seed storage behaviour. Many of these identification tools for seed characteristics will be further developed into the future as more information becomes available. Machine learning was another hot topic throughout this theme. The rise of



Keynote speakers and special guests of the ASSC 2021. Clockwise from top left: Costa Georgiadis (Gardening Australia), Dr Sichong Chen (Millennium Seed Bank, Kew), Prof Robert Henry (Queensland Alliance for Agriculture and Food Innovation), Dr Elinor Breman (Millennium Seed Bank, Kew), Dr Ola T Westengen (Norwegian University of Life Sciences), Prof Brad Sherman (University of Queensland), Dr Terri Janke (Terri Janke and Company) and Dr Sally Norton (Australian Grains Genebank). Photo: ASBP

digitisation and databasing of seed images was captured in several talks that looked at this emerging technology for its applicability to the identification and management of seeds in *ex situ* collections.

Theme 4 – Seeds in Culture and Society

This theme was an important element to the conference program, providing delegates with the ability to better understand the complexity of sourcing, storing and utilising seeds, while respecting and acknowledging the importance of seeds in the cultures of First Nations People.

The theme was chaired by Dr Katherine Whitehouse from the Australian Grains Genebank and was headed by three extraordinary Keynotes who illustrated the need for seed scientists to better understand and navigate culturally and legally appropriate uses of seeds and other germplasm. Dr Terri Janke from Terri Janke and Associates discussed the True Tracks Protocols as a framework for Indigenous engagement. Prof. Brad Sherman from the University of Queensland provided a comprehensive synopsis of the Nagoya Protocol, and how current uncertainty about its use could be addressed. Finally, Dr Ola T. Westengen illustrated how seedbanks collaborating across jurisdictions can safeguard crop diversity, illustrating his point by sharing his perspective on helping with the rescue and reconstitution of the ICARDA seedbank in Syria while working as the head of the Svalbard Global Seed Vault.

The following talks and posters in this session highlighted varying examples of the way that germplasm and traditional knowledge are being used in developing new crops. The final talks in this theme focussed on the importance of partnerships and collaborating across facilities and institutions to improve outcomes for native flora, and why strong and enduring partnerships are vital to the future of germplasm conservation.

Launch of the 3rd Edition of the Germplasm Guidelines

In the last edition of Australasian Plant Conservation (Vol 30 No 2) Amelia Martyn Yenson provided an excellent write up on the launch of the Germplasm Guidelines. We were very pleased to help launch the guidelines during the conference, following many months of hard work across the ANPC and the ASBP to contribute material and case studies for the project. We look forward to using the guidelines for many years to come.

Workshops and Network Discussions

We closed out the week with the aim of further sharing our collective knowledge, developing our specialist skills and to improve opportunities for collaboration across the seed science sector. Workshop 1 presented delegates with the basics of *ex situ* seed conservation including

guidance on preparing and undertaking field collecting; techniques for seed cleaning and processing; and general considerations for the long-term storage of orthodox seeds. Workshop 2 was funded by the Australian Academy of Science and incorporated the *Fenner Conference on the Environment 2021: Exceptional times; exceptional plants*. This workshop drew on examples from the Germplasm Guidelines, providing delegates with the opportunity to learn more about advanced germplasm conservation techniques. Workshop 3 helped delegates to practice using R to improve their ability to analyse and interpret seed-based research data.

To complement the workshops delegates were invited to join a discussion on whether an Australasia-Pacific seed network would benefit seed scientists and what such a network may look like. Over 50 delegates attended the discussions and we look forward to continuing these discussions in the years ahead.

Videos of the conference plenary, the launch of the Germplasm Guidelines by Prof. Tim Entwisle, and the proceedings of the workshops and seed network discussion will all remain available for registered delegates through the Australian Seed Bank Partnership website. Out of respect for the investment of registered delegates, non-registered individuals who are interested in viewing the content can purchase access to view the recordings. <https://www.seedpartnership.org.au/events/australasian-seed-science-conference-2021/>

Special Edition of the Australian Journal of Botany and Australasian Plant Conservation

The program findings and emerging themes will be captured in a special issue of the Australian Journal of Botany and a special edition of the Australasian Plant Conservation bulletin. The ASSC 2021 Scientific Committee is reviewing the talks and abstracts and will identify a selection of papers for each special edition. The APC edition is scheduled for publication in late 2022. The Australian Journal of Botany issue is scheduled for publication in late 2022 and will be headed up by guest editor Dr Mark Ooi from the University of New South Wales.

Australasian Seed Science Conference 2025

During the closing session Dr Lydia Guja, host representative for the ANBG, invited Dr Sal Norton to announce that the Victorian Government's Australian Grains Genebank in Horsham, Victoria will host the Australasian Seed Science Conference in 2025. The 2025 Conference will be delivered as a hybrid event with a comprehensive scientific program, targeted workshops and field trips including the Australian Grains Genebank's facilities, local Indigenous seed business operations, regional national parks, and local agricultural field sites.

We look forward to welcoming ANPC members with an interest in seed science to join us in Horsham in 2025.

Thank you to all our conference partners and sponsors who made the 2021 meeting possible.



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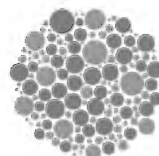
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Banking on seeds for bushfire recovery (part 2)

In continuing our two-part series from the previous issue, we'd like to highlight three more species which were part of the Australian Seed Bank Partnership's 'Banking on Seeds for Bushfire Recovery' project. The project aimed to limit the decline of 25 species from fire affected areas in the ACT, NSW, SA, Vic and WA. The project was funded through a grant from the Australian Government's *Wildlife and Habitat Bushfire Recovery Program*.

Case Study 4

The Pink Mountain Bell (*Darwinia squarrosa*) grows only in the Stirling Range National Park in south-west Western Australia. This small shrub is known as the Pink Mountain Bell for its bell-shaped flowers that are actually clusters of six or seven flowers. *Darwinia squarrosa* is at risk from dieback caused by the mould *Phytophthora cinnamomi* and too frequent fires. The species is listed as Threatened in Western Australia. Under this project, the Department of Biodiversity, Conservation and Attractions in WA established two seed orchards in the Albany region. These seed orchards will increase seed collections of species that are challenging to collect from the wild, including *Darwinia squarrosa*. Eighty-seven *Darwinia squarrosa* seedlings were planted into the seed orchard in late May 2021 with seed collections to be made in the coming seasons.



Image: Andrew Crawford

Case Study 5

Velleia perfoliata is a small plant occurring only in the Hawkesbury District to the Upper Hunter Valley region of New South Wales. Listed as Vulnerable in NSW, you will find this species growing in shallow, sandy soil. *Velleia perfoliata* responds dramatically after fire and this provided staff from the Australian PlantBank at the Australian Botanic Gardens, Mount Annan with a good opportunity to undertake seed collections. They were also able to verify if this species was present at known sites following the 2019–20 fires. At one site in Yengo National Park where habitat was only partially burnt, the species was observed in high abundance in the burnt area but only sporadically in the adjacent intact heath. These findings will inform future management of *Velleia perfoliata*.



Image: Gavin Phillips RBGDT

Case Study 6

Shining Westringia (*Westringia lucida*) is a small shrub found in Kosciuszko National Park, the Australian Capital Territory (ACT) and in Victoria, south of Mount Bogong. The 2019–20 summer bushfires affected the entire range of *Westringia lucida* in Namadgi National Park (ACT). In 2020–21 staff from the National Seed Bank at the Australian National Botanic Gardens assessed and collected seed from 25 plant species affected by recent bushfires, including *Westringia lucida*. In Namadgi National Park four conservation seed collections were secured from the recovering populations. This project also enabled the National Seed Bank to reach new collection sites to increase the genetic diversity of collections for this species. This material is now available for future research on fire impacts, and to secure the future of *Westringia lucida* via *ex situ* conservation work.



Image: Tom North

Download the full fact sheets on these species at: <https://www.seedpartnership.org.au/initiatives/bushfire-recovery/banking-seeds-for-bushfire-recovery/>

Forward together: ANPC-led guidelines informing conservation, restoration and translocation practice

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2021: Completion of a trio of best-practice Guidelines

2021 saw the completion of a suite of ANPC-led guidelines informing plant conservation and restoration in Australia, with publication of the new 'Florabank Guidelines for native seed collection and use' (Commander *et al.* 2021), followed by the third edition of 'Plant Germplasm Conservation in Australia' for *ex situ* conservation (Martyn Yenson *et al.* 2021). These follow the publication of the third edition of the 'Guidelines for the Translocation of Threatened Plants in Australia' (Commander *et al.* 2018). The trio of evidence-based publications addresses the need to protect, manage and restore the biodiverse flora of Australia in the face of threats including fragmentation, disease, changed fire regimes, and climate change. These manuals provide a literature review, up to date best practice and an accessible platform for time-poor and information-hungry practitioners, policy makers, researchers and students. All three guidelines complement the critical work of *in situ* conservation including describing, protecting, monitoring and understanding existing plant communities (Figure 1). Both *in situ* and *ex situ* actions are essential for restoring plant communities.

When and where to use each guideline

The Florabank Guidelines provide an over-arching context for native seed use in ecological restoration. These guidelines describe each step of the seed supply chain, and take us on a journey from *in situ* actions (such as deciding from where to source seeds and collection techniques), to *ex situ* activities (processing, storage, testing, nursery propagation) then back to *in situ* actions (planting and direct seeding). The Germplasm Guidelines complement these by providing a deep dive into the *ex situ* actions, including genetic guidelines for sourcing collections, storage for seeds that don't tolerate freezing or drying, propagation of difficult to grow species (e.g., using tissue culture), cryopreservation and living collections (Table 1). In addition to seeds, the Germplasm

Guidelines covers *ex situ* conservation of vegetative material and spores and highlights the role of nurseries in growing and maintaining plants. The Translocation Guidelines, like the Florabank Guidelines, also take the reader on a journey from *in situ* to *ex situ* and back again, however, these focus on threatened species, and follow the process of threatened species translocation from planning and preparation to implementation and monitoring. The key differences between the Florabank Guidelines and the Translocation Guidelines is that the former focusses on restoration using many species which are not threatened, and, assuming the restoration site is already selected, provides advice on selection of species and provenances; whereas the latter focusses on single species which are threatened, and provides advice on both selecting source material and recipient sites (Table 1).

Given the complexity of conservation and restoration, and the flow of information and propagules required to support these activities, the guidelines illustrate that partnerships are essential for success. For instance, in all three guidelines we see that collaboration is required for planning, seed collecting, processing and banking, germination testing, followed by growing on in the nursery and planting in a translocation site; or direct seeding into a restoration site. These activities can span different parts of an organisation and levels of government, often supported by community involvement. For example, recent translocations of more than 1400 plants of three threatened *Persoonia* species in NSW (<https://www.rbgsyd.nsw.gov.au/Science/Our-work-discoveries/Germplasm-Conservation-Horticulture/Persoonia-conservation/Translocation>) and translocation of the Corrigan Grevillea (*Grevillea scapigera*) in WA (Case study 8.3 in the Translocation Guidelines and https://www.anpc.asn.au/wp-content/uploads/2019/03/APC_27-3_Dec18-Feb19_Dixon.pdf). Within the botanic gardens sector, we see the development of metacollections to spread the workload and risk of managing threatened species.

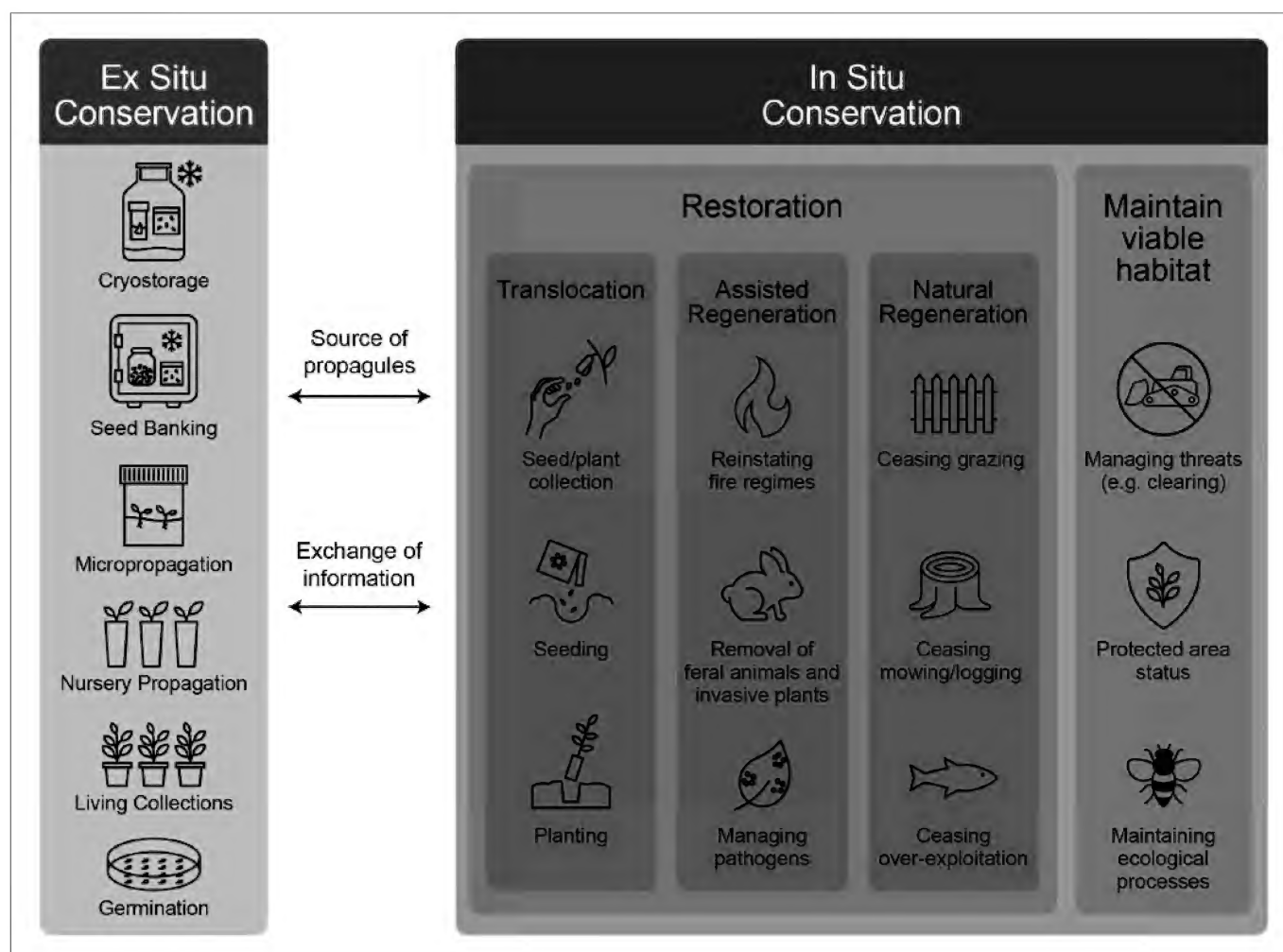


Figure 1. *In situ* and *ex situ* activities can support each other, for instance, *ex situ* research on germination can support actions like seeding and planting, and *in situ* seed collection can support *ex situ* seed banking and living collections (Commander *et al.* 2021 Chapter 1 Florabank Guidelines and Martyn Yenson *et al.* 2021 Chapter 1 Germplasm Guidelines. Figure prepared by Craig Miskell, CAM Graphics)

Table 1. The suite of guidelines provides evidence-based information for practitioners in different conservation settings. The one thing all three guidelines have in common is that they all support action towards restoring functional, self-sustaining plant populations, by providing guidance on different aspects of this process.

	Germplasm Ex situ conservation	Florabank Seeds for restoration	Translocation Threatened plant translocation
Species	Conservation significance and common species	Common species	Threatened species
Differences	Species selection and storage options, collection and maintenance of maternal lines recommended	Species selection and seeding or tubestock	Source and recipient site selection
More detail on	Identification and storage of non-orthodox seeds, living collections, mycorrhiza and rhizobia, non-seed plants, pollen, risk management	Seed production, seed technology, direct seeding, buying and selling seeds	Implementation, maintenance, monitoring and evaluation
Similarities	Genetic diversity, collection, storage, propagation, plant return, record keeping		

Even though we have made leaps and bounds in our knowledge of conservation and restoration, the guidelines clearly convey that these actions don't replace, or negate the need for protection from threats. For example, the possibility of translocation should not be used as a justification for clearing. We are promoting these guidelines to restore what has already been lost, and as insurance against unforeseen events, not as a justification for continual losses.

All three guidelines recognise that managing threats is paramount to the success of conservation and restoration. For example, the need for habitat protection, building resilience and retention of remnants in addition to planting and seeding. The Florabank Guidelines point out that in some cases, seed additions are not needed for restoration, if the threats can be stopped or reversed and the ecosystem has the capacity to regenerate. However, if land is completely cleared, or ecosystems so degraded that species have become locally extinct, then it is likely that one or more species need to be returned. While *ex situ* conservation can be an insurance against threats, and precautionary collections are being made, the Germplasm Guidelines recommend that collections are made for specific purpose(s) and linked to desired outcomes.

The trio of guidelines set an aspirational but practical benchmark for the plant conservation community. Together with a roadmap for seed sourcing and use in NSW (forthcoming from the Healthy Seeds project, <https://www.anpc.asn.au/healthy-seeds/>) and within Australia (<https://www.greeningaustralia.org.au/the-launch-of-australias-first-native-seed-strategy/>), they provide stepping-stones on the route to improving conservation and restoration activities. The challenge is to continue integrating academic and practical approaches, landscape level and single species efforts, and professional, community and volunteer efforts into the future (Maunder *et al.* 2004), all the while advocating for habitat protection and mitigation of threats.

Importance of partnerships for effective conservation and restoration

The ANPC works in partnership with many organisations and individuals across Australia, who have provided generous in-kind support including many hundreds of hours writing and reviewing the trio of guidelines. We rely on the ANPC Committee for their time and input to projects and policy, as well as securing funding to allow coordination and production of these guidelines. Our dedicated office staff and volunteers are critical for managing grants, communication activities and day-to-day enquiries, as well as organising conferences and webinars. We are grateful for the support of funding bodies, both government and non-government, for supporting updates of these guidelines and associated knowledge transfer activities. The Florabank

Guidelines were updated as part of the Healthy Seeds Project, funded by the NSW Government through its Environmental Trust and overseen by a consortium of several organisations: the Centre for Australian National Biodiversity Research, Royal Botanic Garden Sydney, Department of Planning, Industry and Environment (including the Saving our Species program), Australian Seed Bank Partnership, Greening Australia, Australian Association of Bush Regenerators and the Society for Ecological Restoration Australasia. The Germplasm Guidelines were updated with funding from The Ian Potter Foundation, in partnership with the Australian Seed Bank Partnership and the assistance of the restoration and agriculture sectors, botanic gardens, CSIRO and universities. The Translocation Guidelines were funded by the National Environmental Science Program's Threatened Species Recovery Hub, as part of a larger project on threatened plant translocations (<https://www.nespthreatenedspecies.edu.au/projects/threatened-plant-translocations>).

We are indebted to the leading figures and quiet heroes of plant conservation in Australia as we have been updating these guidelines; including the Florabank Consortium; the original ANPC Translocation Working Group (Ken Atkins, John Benson, Kingsley Dixon, Louise Gilfedder, Manfred Jusaitis, Maria Matthes and Maurizio Rossetto) who produced the first edition in 1997 and Laura Vallee, Tricia Hogbin, Leonie Monks, Bob Makinson, Maria Matthes and Maurizio Rossetto who edited the second edition in 2004; and the initial Germplasm Working Group including DH Touchell, Mark Richardson and Kingsley Dixon who edited the first edition of the Germplasm Guidelines in 1997, and Catherine Offord and Patricia Meagher who edited the second edition in 2009. We also acknowledge the contribution of all the chapter and case study authors, reviewers and colleagues who assisted in preparation of each edition of these guidelines. These three guidelines have involved early- and mid-career and senior scientists and practitioners, the latter of whom were involved in earlier editions, and provided mentoring to those earlier in their careers. We hope that these younger authors may then be involved in future updates and pass on their knowledge and experience to the next generation.

International recognition

These Guidelines complement national and international guidelines, for example, Gann *et al.* (2019) and the International Network for Seed-based Restoration (INSR, <https://ser-insr.org/>). They provide practical examples of application in a local context and familiar flora. So, while the three Guidelines are written for management of Australian plant species and use examples and case studies from Australia and New Zealand, many of the approaches, techniques and technologies are applicable to plants across the globe.

Several overseas experts generously assisted with writing and reviewing the publications, especially those from the Millennium Seed Bank at Royal Botanic Gardens, Kew, who store Australian seeds. The Translocation and Germplasm Guidelines have forewords by Joyce Maschinski (V.P. Science and Conservation, Centre for Plant Conservation, USA) and Paul Smith (Secretary General, Botanic Gardens Conservation International) respectively. Several of the authors of the Translocation Guidelines belong to a global Translocation Network, and lead editor Lucy Commander has been invited to give a plenary at the first International Plant Translocation Conference in 2022 (<https://host.uniroma3.it/eventi/IPTC2022/#:~:text=The%20University%20of%20Roma%20Tre,in%20restoring%20threatened%20plant%20species>).

Maunder *et al.* (2004) recommend the development of national guidelines for *ex situ* conservation to ensure standardisation of approaches, adequate genetic representation and maximum longevity for collections. They highlight the role of the Australian guidelines for their use by a broad range of stakeholders. They also advocate development of guidelines for other biodiverse countries which would provide many benefits including the development of best practice conservation activities.

Sharing our expertise

The guidelines are used widely, with more than 900 downloads across 15 modules of the Florabank Guidelines; more than 400 downloads of the 3rd edition of the Germplasm Guidelines (and 113 citations of the previous edition); and more than 100 downloads and purchases, and 38 citations of the Translocation Guidelines (figures for end October 2021), and are in use in teaching, reporting and other avenues that are harder to quantify. A presentation on all three guidelines was made at The Biodiversity Conference 2021: Resilient Landscapes in Perth in September 2021 by Lucy Commander (<https://biodiversity2021.com/wp-content/uploads/2021/09/4.Lucy-Commander.pdf>).

The ANPC is committed to continuing our training with methods that reach across the vast distances within Australia and New Zealand and serving our dedicated but busy audience. We look forward to the Australasian Plant Conservation Conference in Albury in April 2022 (<https://www.anpc.asn.au/conferences/apcc13/>) and in person training, wherever possible. Our collective experience in 2020-21 has shown that we can benefit from online and on-demand access to a wide range of resources. For example, the Plant Treasures video series linked to the Germplasm Guidelines provided background interviews and imagery for the online launch as well as the Australian Academy of Science Fenner Conference on the Environment (<https://www.youtube.com/c/AnpcAsnAu>).

While switching to a virtual format for some webinars in 2021-22, we'll also be unlocking greater access to ANPC resources such as past issues of Australasian Plant Conservation (<https://www.anpc.asn.au/apc-index/>), in addition to our information hubs on Myrtle Rust (<https://www.anpc.asn.au/myrtle-rust/>) and plant recovery from fire (<https://www.anpc.asn.au/plants-and-fire-2020/>). Let us know what topics you'd like ANPC to prioritise for forthcoming training by contacting ANPC's Business Manager Jo Lynch (business@anpc.asn.au). We'll continue to build online resources for training related to the trio of guidelines and encourage uptake of the guidelines in policy and practice.

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Member profile

Barbara Briggs

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I am a botanist and an Honorary Research Associate with the National Herbarium of New South Wales, part of the Royal Botanic Gardens Sydney. Now the Herbarium is moving to a new building at the Australian Botanic Garden at Campbelltown, as part of the new Australian Institute of Botanical Science. Plant conservation depends on knowledge of what species there are and where. That is where herbaria and botanists come in, maintaining the archive of specimen collections that document species occurrence and researching and providing information about species and their relationships.

I was introduced to native plants as a child, with bush walks in the Blue Mountains west of Sydney an important part of most school holidays. When my legs were just long enough, my parents took me walking at Cradle Mountain in Tasmania and later at Kosciuszko. Also, I knew of Albert Morris, who was largely responsible for the vegetation regeneration reserves around Broken Hill and whose name has been given to the Albert Morris Awards for ecological restoration by the Australian Association of Bush Regenerators; he was my Uncle Bert, my aunt's husband. I followed my parents in studying science and, as I learnt about the evolution and complexity of nature and living things, the value of biodiversity became even more apparent. After a few years as a research student at Sydney University, I joined the staff of Sydney's Royal Botanic Garden. I thought that would be a rather brief appointment but I have never left. For many years I headed the science programs of the Gardens.

Now my work is in preparing information on plant species for the online *Flora of Australia* (www.ausflora.org.au). That includes descriptions, species distributions and brief information on habitat and conservation status. Over many decades I have researched, often with colleagues, the evolution and classification of Proteaceae, Myrtaceae and especially Restionaceae, as well as *Ranunculus*, *Veronica* and *Plantago*. This has been a golden age for biological science with analyses of DNA data now giving us greater certainty and detail about the evolutionary relationships of living things than we could only dream of when I started. The technology to obtain and analyse genetic data has opened new horizons and technology also allows us to cooperate globally now, without the past restrictions of geography.

My first botanical project focussed on the alpine buttercups and I was surprised to find four new *Ranunculus* species, not named or described, in an area as well visited as Kosciuszko National Park.



Barbara Briggs

Distinguishing and naming species is important as the conservation needs of species are mostly overlooked until they are named. One of the new species, the Feldmark Buttercup (*Ranunculus acrophilus*), only grows on the highest summits of the Main Range and is threatened by global warming. Over the years I have named 80 new species, many of them Western Australian Restionaceae, and at least 19 of them have state priority listing of conservation concern.

My botanical colleagues are also still finding and naming many new species. Some are new discoveries, never found before, but many have been collected but confused with other species and so not recognised as distinct. A botanist's contribution is not measured by the number of species described but by new insights, and in many plant families we now have better understanding of relationships.

My favourite species? It is hard to decide between *Ranunculus niphophilus*, Snow Buttercup, whose leaves make a bright green turf below snowpatches at Kosciuszko and *Ecdeiocolea monostachya*, Sand Tussock or Mat Rush, in semi-arid Western Australia. *Ecdeiocolea* has been found to be one of the closest relatives of the grasses and has a most ingenious way of promoting

outcrossing, with the sequence of flowering changing the plants from effectively female to male and back again several times in the flowering season.

Many of the people involved with ANPC also support environmental groups that seek to retain areas of natural habitat. ANPC comes to the fore when retaining habitat is not enough. It brings a sharper focus on the science

of restoration, preservation and the special needs of individual species. News of successful projects can inform and energise community groups throughout the country. ANPC's role as a network of information and activity is so important in bringing together natural resource managers, community volunteers, science and philanthropy to focus on urgent conservation needs.

Book review

Plants of Subtropical Eastern Australia

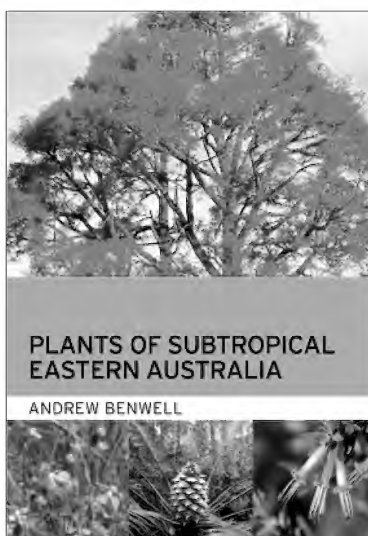
Andrew Benwell

Paperback | December 2020 | \$ 49.99 | ISBN: 9781486313655 | 400 pages | 245 x 170 mm

Publisher: CSIRO Publishing | Colour photographs, Maps

The new publication entitled 'Plants of Subtropical Eastern Australia' and authored by Andrew Benwell is a field guide to the plants, common and threatened, of northeastern NSW and southeastern Queensland. It is a user friendly and visually appealing guide: rather than being arranged alphabetically or by family, plant species are first assembled according to vegetation type (e.g., coastal dune, littoral rainforest, heathlands, wetlands, sclerophyll forest, rainforest and heath – as well as a section on weeds). This format allows users to quickly find their way, especially when in the field. The introductory paragraphs for each vegetation type are wide ranging in the topics covered, while also being concise and easy to read. Topics include biogeography, dominant species, and ecology, for example, the role of fire in wet sclerophyll or the movement of nutrients in the coastal dune environment.

Within each vegetation type plants are then grouped by family and growth form. The book encapsulates information on more than 500 species, with scientific and common names, descriptions (including features for



identification), photos (often more than one, encapsulating habit, vegetative and floral characters) and a map for each. The author has gone to considerable effort to ensure these maps are as accurate as possible – quite a feat given the number of old and inaccurate records of many of these species. I like that this book does not stop at the basics – interesting facts abound: Did you know that the closest relative of the family *Akania bidwillii* is the garden nasturtium? Or that there is no bird large enough to swallow the seed of *Endiandra globosa* in subtropical eastern Australia (the main potential dispersers are cassowaries, but they are limited to northeast Queensland)? The book

also includes some thoughtful 'quick reference' sections, such as a two-page spread of the trunks of common trees in wet sclerophyll forest. The depth and breadth of the knowledge in this book points to the authors' many years of experience working as a botanist in this region.

With sections and information for each taxon arranged clearly – it's an accessible, easy-to-use guide, suitable for beginners and experts alike.

Reviewed by Heidi Zimmer

News and conferences

ANPC News and project updates

Fire and Rust reports released

Extensive surveys assessing the impact of Myrtle rust (*Austropuccinia psidii*) were conducted following the 2019/20 wildfires. The two reports are now available for download from our website and make for sobering reading. Myrtle rust symptoms and damage were found in all survey sites in fire-affected areas of south-east Queensland and NSW south to the Central coast region. New host species have been identified including *Leptospermum speciosum* (Showy tea tree), *Eucalyptus pyrocarpa* (Large-fruited blackbutt) and *Eucalyptus amplifolia subsp. amplifolia* (Cabbage gum). Significant impacts were identified on the endangered *Rhodamnia rubescens* (Scrub turpentine) and *Uromyrtus australis* (Peach myrtle). Myrtle rust symptoms have been observed for the first time on *Eucalyptus pilularis* (Blackbutt) and *Syncarpia hillii* (Satinay) on World Heritage K'gari (Fraser Island). Regeneration of *Melaleuca quinquenervia* (Broad-leaved paperbark), particularly in New South Wales, is of concern with the loss of established trees, and only 15 to 35% of seedlings showing evidence of resistance. *Melaleuca nodosa* (Prickly-leaved paperbark) is highly susceptible to Myrtle rust with only small numbers of trees showing resistance/tolerance to the disease. Longer-term monitoring of all sites is required to understand the longer term impacts of Myrtle rust on Myrtaceae regenerating after wildfire.

https://www.anpc.asn.au/wp-content/uploads/2021/09/8-3-5-Fire-and-Rust-interim-report_v4.pdf

https://www.anpc.asn.au/wp-content/uploads/2021/09/8-3-5-Fire-and-Rust-impact-of-myrtle-rust-on-post-fire-regeneration-update-report_v3.pdf



Germplasm video series

In case you missed it! Want to know why the Germplasm Guidelines were updated and what is included in the third edition? Keen to hear what the contributors think about when they're not writing, researching and growing plants? Check out the Plant Germplasm Conservation playlist on the updated ANPC YouTube channel.

<https://www.youtube.com/c/AnpcAsnAu/playlists>



National Standards launched

The Society for Ecological Restoration Australasia launched Edition 2.2 of the National Standards for the Practice of Ecological Restoration in Australia. This document, in which the ANPC is a proud partner, is a must read for anyone involved in restoring Australia's terrestrial, freshwater and marine ecosystems. To watch a recording of the launch or download the National Standards head to their website. https://www.seraustralasia.org/live-launch/national-standards?mc_cid=09dbf476fb&mc_eid=12073da183



Conference recordings

Recordings of the Australasian Seed Science Conference plenary and workshop sessions are now available to registered delegates at <https://www.seedpartnership.org.au/events/australasian-seed-science-conference-2021/>. These recordings are password protected in recognition of the investment of delegates, but access can be purchased via the same link.

ANPC Conference update

Early bird registrations have opened for the 13th Australasian Plant Conservation Conference! We are holding this in person conference in Albury NSW so delegates can immerse themselves with real people working on real issues in real landscapes (which should look incredible after all this rain!). We are currently accepting abstracts for this event, please submit yours now to secure your place. For details on themes and to download the abstract submission form please visit the conference website.

<https://www.anpc.asn.au/conferences/apcc13/>

Workshops

We have updated the conference website to include information on the three workshops which will be held during the Conference. These include:

Workshop 1: Meeting ambitious restoration goals in the UN Decade on Ecosystem Restoration: national, state, regional and local scale

Workshop 2: Selecting species and provenances: a showcase of tools, templates and approaches

Workshop 3: Best-practice guidelines and methods of plant replacement

You can read the overview of these workshops on our website and don't forget we are open for submissions of abstracts and posters until February 2022.



Call for abstracts

The organising committee is calling for abstracts for our 13th Australasian Plant Conservation Conference to be held in Albury, NSW next April. This is the premier event in Australia to discuss native plant conservation issues. The overall theme is 'Seeds to recovery'. We are seeking abstracts for both presentations and posters which fit within one of the 4 sub-themes:

1. Seeds
2. Bushfire recovery
3. Conservation/threatened species and communities
4. Engaging people with conservation and restoration

We are also seeking abstracts for shorter presentations (5-10mins TBC) on three workshop topics. Please visit our conference website to download the submission form. Abstract submission closes Friday 25 February 2022.

Germplasm Guidelines launch video

On 7 September 2021 Professor Tim Entwisle launched the 3rd edition of the Plant Germplasm Conservation in Australia guidelines. The Germplasm Guidelines are a joint publication of the Australian Network for Plant Conservation and the Australian Seed Bank Partnership, funded by the Ian Potter Foundation. The guidelines showcase the latest techniques, literature and procedures for optimising germplasm storage and use. They are intended for conservation agencies, scientists, seed banks, nurseries and those interested in applied plant biology. For those that were unable to attend the online launch, the recording of this event is now available on our Youtube channel.

https://www.youtube.com/watch?v=Gi_EqF-tdGlandist=PLuPMH5OJZz0H4sZRy3vJ9nussmfStAlonandindex=2

Fenner Conference Recordings

The Australian Academy of Science Fenner Conference on the Environment was held as a virtual conference on 9 September 2021. The theme of 'Exceptional Times, Exceptional Plants' was relevant to a global audience with attendees registered from 29 countries. Three sessions provided an opportunity to elaborate on research and experience presented in the Germplasm Guidelines and discuss the challenges of *ex situ* conservation in Australasia. Recordings of the day's proceedings are now available on the ANPC YouTube channel. Thanks to all the presenters and panellists, as well as the attendees for excellent questions and discussion.

<https://www.youtube.com/playlist?list=PLuPMH5OJZz0EMTTwrZA50UbBrOx4WnaGh>

4th Seasons of Seed workshop held

The last workshop in the 4 Seasons of Seed series was held on Friday 5 November in Conargo, NSW. This free Spring workshop focussed on site management and was led by the ANPC's Healthy Seeds Project Manager Dr Martin Driver.

Open access articles

The ANPC has been involved in publishing two open access articles in the September 2021 edition of Restoration Ecology. These papers highlight the constraints faced by the Australian Native Seed Sector which is critical for restoration. Seed is the key ingredient in restoration work around Australia yet this sector faces numerous challenges. The sector comprises of a small, under resourced workforce who will struggle to meet future demands for seed from wild harvest. Current seed collections are from fragmented land tenures, are seldom quality tested and not sufficient to support large-scale restoration. To understand more about the future of the native seed industry in Australia please read and share these articles:

Article 1 – Australian native seed sector characteristics and perceptions indicate low capacity for upscaled ecological restoration: insights from the Australian Native Seed Report.

<https://onlinelibrary.wiley.com/doi/10.1111/rec.13428>

Article 2 – Australian native seed sector practice and behavior could limit ecological restoration success: further insights from the Australian Native Seed Report.

<https://onlinelibrary.wiley.com/doi/10.1111/rec.13429>

Native Seed industry Working Group

In exciting news, the Australian Seed Federation Board is establishing a new working group for the native seed industry sector. This is something for which the ANPC has advocated for a long time. The new group, to be called the 'Native Seed Industry Working Group' will provide a representative group for seed companies involved in the native seed industry sector. To be involved in this group, native seed companies must be members of the Australian Seed Federation.

AGM committee update

On Wednesday 17 November 2021 the ANPC held our AGM over Zoom with 25 people in attendance. The ANPC president, Tony Auld, presented his President's Report which can be read here (<https://www.anpc.asn.au/annual-report/>). The President's Report details what the ANPC has achieved over the last year, and the activities we are looking forward to. We also said thank you and farewell to our committee members Paul Gibson-Roy, Stephen Bell and Bob Makinson who have finished their terms. We welcomed three new ordinary members to the ANPC management committee, Kelli Gowland and Damian Wrigley from the ACT and Cathy Offord from NSW.



13th Australasian Plant Conservation Conference 'Seeds to recovery'



Australian Network for
Plant Conservation Inc

Sun 3 - Thurs 7
APRIL 2022
Albury NSW



More info at www.anpc.asn.au/conferences/apcc13/

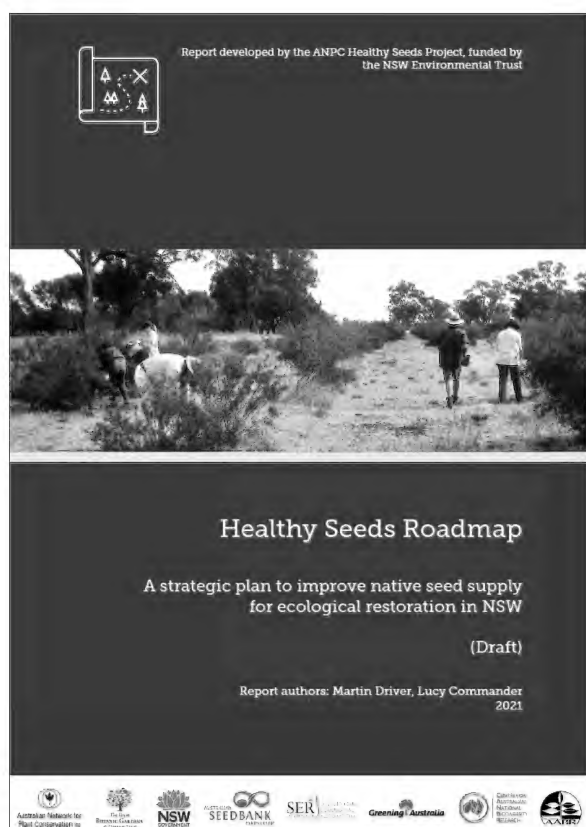
Have your say – training

We are currently planning our future training related to the new third edition of the Germplasm Guidelines. If you would like to dive into the details of a particular chapter, technique or challenge, please contact Project Manager Amelia Martyn Yenson (amelia.yenson@botanicgardens.nsw.gov.au). If you would like to get involved in training or webinars related to the Florabank or Translocation Guidelines, please contact ANPC Business Manager Jo Lynch (business@anpc.asn.au). We welcome all ideas for future training, including discussion of your preferred training method, so we can work towards meeting the needs of our network.

Healthy Seeds Project Update

Stage 1 of the Healthy Seeds project is coming to completion with the draft Roadmap submitted to the NSW Environmental Trust and the Healthy Seeds Consortium in November 2021. The Roadmap integrates the results of the Australian Native Seed Survey Report, the Audit of Seed Production Areas in NSW and the identification of the barriers and opportunities for the NSW seed sector to provide a strategic plan to improve native seed supply for ecological restoration in NSW. The full Roadmap is available on the ANPC website, along with the roadmap summary.

<https://www.anpc.asn.au/healthy-seeds/>



ANPC Membership Special Offer

Join the Australian Network for Plant Conservation before **30 June 2022** to receive 2 free editions of the *Australasian Plant Conservation* bulletin!



Member benefits include:

- Quarterly editions of the APC journal
- Discounts to the ANPC's workshops, conferences and forums

Launch of national seed strategy

On 24 November 2021 the federal Minister for the Environment Sussan Ley launched the National Native Seed Strategy developed through Project Phoenix. The ANPC was proud to collaborate with Greening Australia, producing three reports through Project Phoenix and providing expertise through the Healthy Seeds project and update of the FloraBank Guidelines. Read the media release here (<https://minister.awe.gov.au/ley/media-releases/banking-future-our-rarest-plant-species>) and download the Strategy here (https://www.greeningaustralia.org.au/wp-content/uploads/2021/11/Australian-Native-Seed-Strategy_Final.pdf).

Plant Heroes

The Plant Heroes series, funded by an ANPC grant, continues with a fascinating video and podcast on Murnong – a type of Yam Daisy (*Microseris scapigera*). For the Wurundjeri Woi Wurrung and other Aboriginal groups in south-eastern Australia, the Murnong has been an important cultural food source for thousands of years. But today only three populations remain in Melbourne, these rely on active management to keep them alive. Watch the video here:

<https://www.plant-heroes.com/species/murnong>



Plant Cuttings

Editors' note: News excerpts are clipped from a diversity of sources. To read the articles in full follow the links attached to each clipping. The views expressed in these articles are those of their authors and do not necessarily represent the opinion of the ANPC.

Most of Australia's threatened plant species aren't being monitored increasing the risk of extinctions – NESP media release, 22 July 2021

Most of Australia's threatened plants aren't being monitored, increasing the risk of extinctions. Almost two-thirds (63%) of threatened Australian plants are not receiving any monitoring according to a recent national assessment published in Biological Conservation. <https://www.nespthreatenedspecies.edu.au/news-and-media/media-releases/most-of-australia-s-threatened-plants-aren-t-being-monitored-increasing-the-risk-of-extinctions>

Cacti were once considered a pest. Now they're the most illegally trafficked houseplants in the world – ABC News, 18 August 2021

Cacti experts estimate that of the world's known cacti species, almost a third are threatened with extinction. And Ms Nuwer says illegal cacti trafficking is the number one threat to the decline in species. <https://www.abc.net.au/news/2021-08-18/cacti-trafficking-illegal-trade-international/100349306>

Plan to plant a billion trees yet to take root three years after target set, ABC Rural, 31 August 2021

In September 2018, the federal government unveiled a plan to radically expand Australia's timber plantations by one billion trees over a decade. Today, less than 1 per cent of that goal has been planted. <https://www.abc.net.au/news/rural/2021-08-31/slow-progress-on-plan-to-plant-billion-trees/100421414>

Living with giants: the beauty of Victoria's ash forests, ANU Newsroom, 31 August 2021

Ancient rainforests that sustained our First Nations peoples, trees the height of 25-storey buildings and gliding marsupials larger than any other -- these are just some of the wonders found in Victoria's mountain ash forests. A new book tells their incredible stories through stunning photography. <https://www.anu.edu.au/news/all-news/living-with-giants-the-beauty-of-victoria%E2%80%99s-ash-forests>

Flies like yellow, bees like blue: how flower colours cater to the taste of pollinating insects, The Conversation 2 September 2021

We all know the birds and the bees are important for pollination, and we often notice them in gardens and parks. But what about flies? <https://theconversation.com/flies-like-yellow-bees-like-blue-how-flower-colours-cater-to-the-taste-of-pollinating-insects-167111>

Deadwood releasing 10.9 gigatons of carbon every year, ANU Newsroom, 2 September 2021

Decaying wood releases around 10.9 gigatons of carbon worldwide every year, according to a new study by an international team of scientists. This is roughly equivalent to 115 per cent of fossil fuel emissions. Co-author of the study Professor David Lindenmayer from The Australian National University (ANU) says it's the first time researchers have been able to quantify the contribution of deadwood to the global carbon cycle. <https://www.anu.edu.au/news/all-news/deadwood-releasing-109-gigatons-of-carbon-every-year>

How plants use colour to attract insects, Evenings With Mel Bush, 6 September 2021

Adrian Dyer, Associate Professor from RMIT University, talks to Mel Bush about the special relationship between flowers and their pollinators and how colour is used to attract said insects. <https://www.abc.net.au/radio/hobart/programs/evenings/adrian-insects/13529776>

IUCN Green Status of Species: a global standard for measuring species recovery and assessing conservation impact: version 2.0

The decline of many species towards extinction has largely focused conservation efforts on ensuring that species remain extant. However, conservationists have long recognised the need to complement this by aiming to recover depleted populations throughout a species' range and to restore species to ecosystems from which they have been extirpated. The main objectives of the IUCN Green Status of Species are: to provide a standardised

framework for measuring species recovery; to recognise conservation achievements; to highlight species whose current conservation status is dependent on continued conservation actions; to forecast the expected conservation impact of planned conservation action; and to elevate levels of ambition for long-term species recovery. These objectives together encourage conservation towards species recovery, throughout a species' range.
<https://portals.iucn.org/library/node/49511>

New IUCN green status launched to help species 'thrive, not just survive' – The Guardian, 28/7/21

Conservation tool will focus on recovery efforts to give a fuller picture of threats to plant and animal populations.
<https://www.theguardian.com/environment/2021/jul/28/new-iucn-green-status-launched-to-help-species-thrive-not-just-survive-aoe>

A new 'green status of species' will measure the recovery of threatened plants and animals – The Washington Post, 29/7/21

Rather than focus on decline, the new standard from the IUCN highlights successful conservation work — and incentivizes future efforts
<https://www.washingtonpost.com/climate-solutions/2021/07/28/green-status-endangered-species-iucn/>

Conservation, recreation key to SA's newest national park 8/8/2021

A new national park on the Fleurieu Peninsula is set to become an ecological haven for threatened native animals and plant species as well as an adventure-tourism destination for mountain biking and hiking.
<https://www.premier.sa.gov.au/news/media-releases/news/conservation,-recreation-key-to-sas-newest-national-park>

Wildflower season the best in years as WA Midwest winter rains bring bursts of colour ABC Mid West and Wheatbelt, 21/8/21

The best wet winter rains in years have sparked a bumper wildflower season in Western Australia's Midwest. Wildflower viewing hotspots like Coalseam Conservation Park near Mingenew are awash with colour as whole fields transform into seas of yellow, white, and pink everlasting daisies. And those who take the time to get out of the car will discover a myriad of other flowers in intricate designs and dazzling hues in bushland across the region. But why is this ancient and often infertile land such a wonderland for wildflowers?
<https://www.abc.net.au/news/2021-08-21/midwest-wildflowers/100386402>

Conservation of Earth's biodiversity is embedded in Indigenous fire stewardship – PNAS, 10/8/21

Large and severe wildfires are becoming increasingly common worldwide and are having extraordinary impacts on people and the species and ecosystems on which they depend. Indigenous peoples comprise only 5% of the world's population but protect approximately 85% of the world's biodiversity through stewardship of Indigenous-managed lands. Much of this is attributed to long-term and widespread relationships with and dependence on fire, which has been applied as a tool for managing landscapes for millennia. Fortunately, the revitalization of Indigenous fire stewardship is demonstrating the value of routinely applying controlled fire to adapt to changing environments while promoting desired landscapes, habitats, and species and supporting subsistence practices and livelihoods.
<https://www.pnas.org/content/118/32/e2105073118>

More than 100 new landcare projects for bushfire impacted regions – 12/7/21

Training communities to monitor and recover critical mangrove habitat on the NSW south coast, the restoration of Macquarie Perch habitat in alpine waterways, and helping Greater and Yellow-bellied Gliders in South-East Queensland are among 111 new bushfire recovery Landcare grant projects. Minister for the Environment Sussan Ley said the new projects are part of a \$14 million Morrison Government commitment to deliver on-ground activities to aid in the recovery of native wildlife and habitat in seven regions severely impacted by the Black Summer bushfires.
<https://nsw.liberal.org.au/Shared-Content/News/2021/More-than-100-new-landcare-projects-for-bushfire-impacted-regions>

Planning to plant an Australian native like wattle? Read this first — you might be spreading a weed- The Conversation, 18/7/21, by Singarayer Florentine

Australian native plants are having a moment in the sun, with more of us seeking out and planting native species than in the past. Our gardens — and our social media feeds — are brimming with beautiful Australian native blooms. But not all Australian native species belong in all Australian environments. In fact, many have become pests in places far from their original homes.
<https://theconversation.com/planning-to-plant-an-australian-native-like-wattle-read-this-first-you-might-be-spreading-a-weed-165165>

1 in 2 primary-aged kids have strong connections to nature, but this drops off in teenage years. Here's how to reverse the trend – The Conversation, 16/8/21

Parents and researchers have long suspected city kids are disconnecting from nature due to technological distractions, indoor lifestyles and increased urban density. Limited access to nature during COVID-19 lockdowns has heightened such fears.

<https://theconversation.com/1-in-2-primary-aged-kids-have-strong-connections-to-nature-but-this-drops-off-in-teenage-years-heres-how-to-reverse-the-trend-165660>

Communicating climate change has never been so important, and this IPCC report pulls no punches

On Monday, the Intergovernmental Panel on Climate Change (IPCC) released the first instalment of their sixth assessment report. As expected, the report makes for bleak reading. It found all regions of the world are already experiencing the impacts of climate change, and its warming projections range from scary to unimaginable.

<https://theconversation.com/communicating-climate-change-has-never-been-so-important-and-this-ipcc-report-pulls-no-punches-165252>

480 million-year-old fossil spores from Western Australia record how ancient plants spread to land – The Conversation, 13/8/21

When plants first ventured onto the land, evolving from freshwater-dwelling algae, more than 500 million years ago, they transformed the planet. By drawing carbon dioxide from the air, they cooled Earth, and by eroding rock surfaces they helped build the soil that now covers so much land.

<https://theconversation.com/480-million-year-old-fossil-spores-from-western-australia-record-how-ancient-plants-spread-to-land-166016>

Indigenous plants and food security: a South African case study - The Conversation, 3/8/21

Food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food. This must meet their dietary needs and preferences for an active and healthy life. In South Africa, some reports show that the country is nationally food secure. However, there are variations in reports from communities and at household level. Some studies show high levels of food insecurity in different parts of the nation.

<https://theconversation.com/indigenous-plants-and-food-security-a-south-african-case-study-164740>

We asked landholders how they feel about biodiversity offsets — and the NSW government has a lot to learn – The Conversation, 5/8/21

When land is cleared to make room for urban growth, infrastructure, mining, and so on, developers are often required to “offset” their environmental damage by improving biodiversity elsewhere. This could mean, for example, planting trees along a river, or building shelters for animals that lost their habitats. In New South Wales, one mechanism to fulfil this requirement is the Biodiversity Offsets Scheme, and a NSW parliamentary inquiry into this scheme is currently underway. The inquiry will look into the scheme’s administration, transparency and oversight, and will investigate the ability for private landowners to engage in it.

<https://theconversation.com/we-asked-landholders-how-they-feel-about-biodiversity-offsets-and-the-nsw-government-has-a-lot-to-learn-164934>

How would planting 8 billion trees every year for 20 years affect Earth’s climate? – The Conversation, 23/8/21

Politicians, business leaders, YouTubers and celebrities are calling for the planting of millions, billions or even trillions of trees to slow climate change. There are currently almost 8 billion people on Earth. If every single person planted a tree each year for the next 20 years, that would mean roughly 160 billion new trees. Could massive tree planting actually slow climate change?

<https://theconversation.com/how-would-planting-8-billion-trees-every-year-for-20-years-affect-earths-climate-165284>

Pasha 120: Botanical gardens: why we need them and how they can also pose a risk – The Conversation, 19/8/21

The team behind our podcast, Pasha, has started a series called “Why We Need” and this first episode is about why we need botanical gardens. Botanical gardens are dedicated to the collection, cultivation, preservation and display of plants. Around the world, they contain 30%-40% of the known plant species. Not only do they maintain documented collections of plants, these institutions carry out research and contribute to education and conservation. So they’re really valuable resources for people interested in plants.

<https://theconversation.com/pasha-120-botanical-gardens-why-we-need-them-and-how-they-can-also-pose-a-risk-166288>

Rare plants damaged in Black Summer to be protected at National Botanic Gardens- Queensland Country Life, 23/8/21

Some of Australia's rarest plant species hit hard by the Black Summer bushfires in Namadgi and Kosciuszko national parks will be protected as part of a new conservation scheme. The program, a joint-partnership between the ACT government, the Australian National Botanic Gardens and conservation groups, will help to collect seeds of plant species burnt out by the fires and help create a reserve population.

<https://www.queenslandcountrylife.com.au/story/7397416/green-shoots-planned-for-plant-species-damaged-by-black-summer-fires/?cs=4698>

Four questions, five messages and six fronts for ecosystem restoration – IUCN, 7 September 2021

Restoring our beleaguered ecosystems means working together to secure the massive investment needed to reverse environmental degradation, according to an IUCN think piece. Restoring carbon- and species-rich ecosystems on land and in the ocean is also highly effective for both climate change mitigation and biodiversity, with large adaptation co-benefits.

<https://www.iucn.org/news/nature-based-solutions/202109/four-questions-five-messages-and-six-fronts-ecosystem-restoration>

The woman saving Palestinian heirloom seeds, BBC News, 10 September 2021

To seed librarian Vivien Sansour, seeds are living beings, and to see heirloom seeds disappearing is a human tragedy. Sansour didn't start out intending to create The Palestine Heirloom Seed Library. Born out of a longing to find the traditionally grown Palestinian food she grew up eating, the seed library took root in 2014. <https://www.bbc.com/travel/article/20210908-the-woman-saving-palestinian-heirloom-seeds?ocid=ww.social.link.email>

The daily dance of flowers tracking the sun is more fascinating than most of us realise, The Conversation, 10 September 2021

When I was a child, I was intrigued by the Queensland box (*Lophostemon confertus*) growing in our backyard. I noticed its leaves hung vertical after lunch in summer, and were more or less horizontal by the next morning. This an example of heliotropism, which literally means

moving in relation to the sun. We can see it most clearly as spring arrives and various species burst into flower — you might even get the feeling that some flowers are watching you as they move.

<https://theconversation.com/the-daily-dance-of-flowers-tracking-the-sun-is-more-fascinating-than-most-of-us-realise-167374>

Destroying vegetation along fences and roads could worsen our extinction crisis — yet the NSW government just allowed it – The Conversation, 17 September 2021

What do koalas, barking owls, greater gliders, southern rainbow skinks, native bees, and regent honeyeaters all have in common? Like many native species, they can all be found in vegetation along fences and roadsides outside formal conservation areas.

<https://theconversation.com/destroying-vegetation-along-fences-and-roads-could-worsen-our-extinction-crisis-yet-the-nsw-government-just-allowed-it-167801>

Domestic tourism boom threatens local plant species, ABC News 21 September 2021

An influx of tourists visiting Western Australia's forests could spell disaster for plant species with researchers worried about the spread of devastating dieback. The combination of a boom in intrastate tourists due to WA's tight COVID borders and a wet winter, causing more mud, creates ideal conditions for the spread of the fungal disease, which has already killed more than one million hectares of native bush in the state.

<https://www.abc.net.au/news/2021-09-21/dieback-domestic-tourism-boom/100479574>

Climate change is testing the resilience of native plants to fire, from ash forests to gymea lilies, The Conversation, 21 September 2021

But in recent years, the length, frequency and intensity of Australian bushfire seasons have increased, and will worsen further under climate change. Droughts and heatwaves are also projected to increase, and climate change may also affect the incidence of pest insect outbreaks, although this is difficult to predict.

<https://theconversation.com/climate-change-is-testing-the-resilience-of-native-plants-to-fire-from-ash-forests-to-gymea-lilies-167367>

Landmark Report Released – BGCI Press Release

Botanic Gardens Conservation International (BGCI) has published a landmark State of the World's Trees report. The report, compiling work led by the Global Tree Assessment (GTA), is the culmination of five years of research to identify major gaps in tree conservation efforts. It is one of the first assessments of the world's threatened trees.

<https://www.bgci.org/news-events/bgci-launches-the-state-of-the-worlds-trees-report/>

How drones are helping our threatened plants – NZ Department of Conservation blog, 30 Sept 2021

Funding in Budget 2018 has opened a new frontier of drone technology for use in threatened plant conservation. "Zoom in!" – "Zoom in harder!" – "Yes! There! It is one! We've got one!" Jan is glued to the screen. And she is ecstatic. She has just found the proverbial needle in the haystack – a tiny little plant, no larger than a 10-cent piece, growing high up on a large, vertical cliff.

<https://blog.doc.govt.nz/2021/09/30/how-drones-are-helping-our-threatened-plants/>

Most of Australia's threatened plants aren't being monitored, increasing the risk of extinctions – Threatened Species Recovery Hub, 22 July 2021

Most of Australia's threatened plants aren't being monitored, increasing the risk of extinctions. Almost two-thirds (63%) of threatened Australian plants are not receiving any monitoring according to a recent national assessment published in Biological Conservation. This puts these species at much greater risk of ongoing declines and extinctions according to the lead author of the study Dr Tyrone Lavery from The Australian National University.

<https://www.nespthreatenedspecies.edu.au/news-and-media/media-releases/most-of-australias-threatened-plants-aren-t-being-monitored-increasing-the-risk-of-extinctions>

Biodiversity depends on pollinators: a first estimate of how many plants rely on animals – The Conversation, 14 October 2021

The honeybee may be the best-known pollinator of plants, but there are thousands of pollinator species, including other bees, butterflies, moths, beetles, flies and even some birds and mammals. Pollinators help to produce food – their contribution to crops is

worth billions of dollars. But they are also essential for the reproduction of plants generally, and thus for biodiversity.

<https://theconversation.com/biodiversity-depends-on-pollinators-a-first-estimate-of-how-many-plants-rely-on-animals-166908>

Kew's Science Strategy

The Kew Science Strategy 2021 – 2025 outlines an ambitious plan to help stop biodiversity loss and discover sustainable nature-based solutions to some of the biggest global challenges.

https://www.kew.org/science/our-science/publications-and-reports/science-reports/kew-science-strategy?utm_campaign=961838_Science%20-%20Kew%20Science%20Strategy%20011021andutm_medium=emailandutm_source=Kewandutm_content=ScienceStrategyText011021anddm_i=4THF,KM5Q,4AM8SC,2GSO9,1

Australia's 100 Priority Species – DAWE 22 October 2021

From the Quokka, Green Sea Turtle, the Australian Sea Lion, the Greater Bilby, the Koala to the Orange-Bellied Parrot, the Morrison Government has announced 100 Priority Species that will be the focus of further conservation efforts under its 10-year Threatened Species Strategy, and an immediate \$10 million in community grants for on ground activities.

<https://minister.awe.gov.au/ley/media-releases/australias-100-priority-species?fbclid=IwAR1khxsnj0hnQS86tKAqEZm5kzrbWAH-5PpVD0MKL8NdM9e28vDTFDMctP4>

World's smallest wattle plant found blooming on K'gari (Fraser Island) a year after bushfire – ABC News, 23 October 2021

The world's smallest wattle plant has been found blooming in the bushfire-scorched grounds of K'gari (Fraser Island), with experts saying it shows the island is in full recovery mode. Queensland Parks and Wildlife Service (QPWS) rangers were amazed to find the miniature bright yellow flowers of the *Acacia baueri*, a threatened species commonly known as the tiny wattle, during recent surveys of areas affected by fire a year ago.

<https://www.abc.net.au/news/2021-10-23/worlds-smallest-wattle-survives-kgari-fraser-island-bushfire/100556326>

Scientists scour Australian rivers in canoes looking for new varieties of taro, the ‘food of the gods’ that’s threatened by climate change – ABC News, 24 October 2021

A team of Queensland scientists have traded their lab coats for paddles and canoes, as they scour the Brisbane River in search of “the food of the gods”. They’re hunting for new varieties of taro – a starchy vegetable crop – that could help improve food security in the Pacific.
<https://www.abc.net.au/news/2021-10-24/scientists-canoes-taro-food-of-gods-climate-change/100556014>

Ground-breaking project first step on path to restore Norfolk Island – Invasive Species Council, 27 October 2021

A clear picture of what Norfolk Island looked like before European arrival has emerged from a project that has, for the first time ever, mapped native vegetation across the entire island, as it exists now and before 1750.

<https://invasives.org.au/media-releases/ground-breaking-project-first-step-on-path-to-restore-norfolk-island/>

Events and opportunities

Australasian Systematic Botany Society Conference

The 2021 virtual conference had 86 presentations watched by 237 attendees from 7 countries. The recordings of all keynotes and session talks of this ASBS conference are now available online. To view the recordings, please log into the ASBS 2021 conference website at <https://asbs2021.bablglobal.com/> and go to the replays tab at <https://asbs2021.bablglobal.com/replays/>. To navigate to the recordings of the sessions of each day, please refer to the conference program here: <https://drive.google.com/file/d/1YIFyDvuyHh7f7dlkD-sWIG44Wltz0aDW/view>

DAWE Podcast – Detect and Protect

In addition to the National Biosecurity Series webinars, the department has recently launched Detect and Protect – the new Australian biosecurity podcast. The discussions include the key components of Biosecurity 2030, the significant pest and disease threats facing Australia, how innovation and collaboration is helping strengthen the biosecurity system and the important role of the public in supporting biosecurity.

<https://www.awe.gov.au/biosecurity-trade/policy/australia/public-awareness/detect-protect>

Millennium Seed Bank Partnership Newsletter

The international newsletter of the Millennium Seed Bank Partnership (MSBP) has now moved to an online only format. The e-newsletter is published three times a year in March, June and September, starting September 2021. It aims to share up-to-date news and stories from across the MSBP as well as share information of relevance to the partnership. Sign up here

<https://brahmsonline.kew.org/msbp/Samara/ENewsletter>

BCARM Plant Forum

Each month the BGANZ Collections and Records Management Group (BCARM) holds an online forum. The October 2021 forum featured the ANPC’s Project Manager, Amelia Martyn-Yenson speaking about the Germplasm Guidelines update. You can watch the recording here

<https://www.youtube.com/watch?v=DKchgmxmHSE>

Australian Biosecurity Webinar Series

This webinar series covers a range of biosecurity topics, such as Australia’s priority biosecurity risks and how they are being managed, preparedness and response activities, innovation, and collaboration, as well as priorities and challenges for biosecurity. Watch a webinar to hear from government and industry experts about current priorities for our biosecurity work. Watch recordings here

<https://www.awe.gov.au/biosecurity-trade/policy/australia/public-awareness/webinar-series>

RIAWA 2021 Seminar “The Revegetation Cycle”

On 13-14 October 2021 in Perth, the Revegetation Industry Association of WA held their 2021 seminar titled “The Revegetation Cycle”. The ANPC’s project manager Dr Lucy Commander gave a keynote presentation on the Florabank Guidelines. For presentation recordings see

<https://www.riawa.com.au/events/the-revegetation-cycle>

Research round up

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School of Biological, Earth and Environmental Sciences, University of New South Wales

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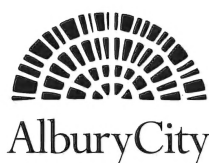
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CHAPTER LIST

- 1 Introduction
- 2 Options, major considerations and preparation for plant germplasm conservation
- 3 Genetic guidelines for acquiring and maintaining collections for ex situ conservation
- 4 Seed and vegetative material collection
- 5 Seed banking: orthodox seeds
- 6 Identifying and conserving non-orthodox seeds
- 7 Seed germination and dormancy
- 8 The role of the plant nursery in ex situ conservation
- 9 Tissue Culture
- 10 Cryopreservation
- 11 Living Plant Collections
- 12 Isolation, propagation and storage of orchid mycorrhiza and legume rhizobia
- 13 Special collections and under-represented taxa in Australasian ex situ conservation programs
- 14 Risk management and preparing for crises
- 15 Maintenance, utilisation and information storage



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